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BOARD OF TRUSTEES, AMERICAN DENTAL ASSOCIATION

THE JOURNAL
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Original Communications

EPITHELIUM AND THE PHYSIOLOGIC POCKET*

By W. G. SKILLEN, D.D.S., and EMIL MUELLER, D.D.S., M.S., Chicago, Illinois

BEFORE pathology can be properly comprehended, physiology must be understood. Researches of the past pertaining to pyorrhea alveolaris have been directed entirely too much toward the advanced clinical as well as the advanced micropathologic picture. In spite of numerous and diligent investigations, the true etiology of the disease still remains obscure. If the etiology ever is revealed, it will be upon the basis of a more thorough knowledge of the physiologic as well as the early pathologic behavior of the parts involved.

This fact has already been recognized by the ingenious and most industrious dental research pathologist of our day, Dr. Gottlieb of Vienna. His publication "The Epithelium at the Teeth,"[1] marks the beginning of a new era in pyorrhea research. This article with the following, "Pyorrhea Alveolaris and the Biology of the Cementum,"[2] "The Diffuse Atrophy of the Alveolar Bones,"[3] "Filth Pyorrhea, Paradental

*From the Research Department of the Northwestern Dental School.

*Read before the Section on Bacteriology, Pathology and Diagnosis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Gottlieb, Bernhard: Epithelial Attachment of the Tooth, Deutsch. Monatschr. f. Zahnhlk., No. 5, 1921.

2. Gottlieb, Bernhard: Pyorrhea Alveolaris and the Biology of the Cementum, Ergebn. d. Ges. Zahnhlk., 1922.

3. Gottlieb, Bernhard: Diffuse Atrophy of the Alveolar Bones, Ztschr. f. Stomatol., No. 4, 1923.

Pyorrhea and Alveolar Atrophy,"[4] "Paradental Pyorrhea and Alveolar Atrophy,"[5] is such a masterpiece of observation and so fertile with new suggestions, that a study on any phase of this subject can hardly be considered complete unless it takes into account these numerous and keen observations.

It is common knowledge that the pocket is involved in every case of pyorrhea. Since the pocket is an essential, the study of its development is desirable.

Up until 1921, it was universally accepted that, as soon as the tip of tooth had broken through the gum, the bottom of the pocket was located at the cemento-enamel junction, and that when the tooth had reached the line of occlusion, it was fully erupted. This conception persisted without foundation until the research of Gottlieb[1] in which he showed that in reality no pocket existed at the time of eruption, but that the tooth was organically united with the epithelium. Since that time, this work has been verified by Orban and Koehler,[6] Römer,[7] Neuwirth,[8] Norberg,[9] Weski,[10] Euler,[11] Lund,[12] Meyer,[13] Orban,[14] and Adrion.[15] Although great differences of opinion persist as to the exact detail of pocket development, in the main, Gottlieb's contentions have weathered the storm.

The newer conception regarding tooth eruption, the cuticula and physiologic pocket development is quite common knowledge in the central European countries, particularly in Germany and Austria. On the contrary, in this country, it is almost entirely unknown. On account of the extreme importance of this work, we will limit this paper to a brief review of the important literature on this subject, discuss and emphasize the high points, and offer such corroborating evidence as has been encountered in our study. We wish to add our support to these investigations and also hope that we may, in a small way, aid in gaining recognition for these important developments.

Closely allied to pocket development is the development and function of Nasmyth's membrane, also known as enamel cuticle, ameloblastic cuticle,

4. Gottlieb, Bernhard: Filth Pyorrhea, Paradental Pyorrhea and Alveolar Atrophy, Fortschr. d. Zahnhlk., No. 8, 1925.

5. Gottlieb, Bernhard: Paradental Pyorrhea and Alveolar Atrophy, Fortschr. d. Zahnhlk., 1926.

6. Orban and Koehler: Physiologic Pocket; Epithelial Attachment and Epithelial Burrowing, Ztschr. f. Stomatol., No. 6, 1924.

7. Römer: Pathologic-Anatomic Fundamentals of So-Called Pyorrhea Alveolaris, Deutsch. Zahnhlk., No. 66, 1925.

8. Neuwirth: Enamel Cuticle and the Epithelial Attachment of the Tooth, Ztschr. f. Stomatol., No. 4, 1925.

9. Norberg: Critical Discussion of Newer Conceptions of the Histology and Biology of the Teeth, Vjschr. f. Zahnhlk., No. 1, 1924.

10. Weski: Radiologic-Anatomic Studies of the Pathology of the Jaw, Vjschr. f. Zahnhlk., No. 1, 1921.

11. Euler: Epithelial Attachment in a New Light, Vjschr. f. Zahnhlk., No. 1, 1923.

12. Lund: Cuticula Dentis, Vjschr. f. Zahnhlk., No. 1, 1925.

13. Meyer: Disputed Questions Concerning the Histology of the Enamel, Vjschr. f. Zahnhlk., No. 3, 1925.

14. Orban: Enamel and Cuticula Dentis, Enamel Lamellae and Tufts, Ztschr. f. Stomatol., No. 2, 1926.

15. Adrion: Comparative Histologic Research on the Behavior of the Epithelium at the Neck of the Tooth, Deutsch. Monatschr. f. Zahnhlk., No. 8, 1926.

epithelial cuticle, the cuticula dentis,[16] etc. In the light of the newer knowledge, greater theoretical as well as practical importance is assigned to this structure than was previously accredited to it. It is intimately involved in all diseases of the gums, particularly pyorrhea, and probably plays an important part in the etiology of caries. In his study on "The Etiology and Prophylaxis of Dental Caries,"[17] and "Paradental Pyorrhea and Alveolar Atrophy,"[5] Gottlieb has stressed ways in which this structure may also be involved in the occurrence of caries.

The earliest description of this structure was that by Nasmyth,[18] whose name today is still widely applied to it. He conceived it as a cellular capsule of cementum. His conception was amplified later by both Sir John Tomes[19] and Sir Charles Tomes.[20] After years of discussion by numerous writers, two distinct views developed, that of Waldeyer and that of Kolliker[21] and Ebner. According to Waldeyer, the cuticula represented the outer epithelial layer of the enamel organ with probably some of the stratum internum; while Kolliker[22] believed that it was a protective covering of the enamel laid down after the enamel had fully developed. Ebner supported this view. Impressions such as these, with numerous variations, were common up to the time when Gottlieb approached the problem and shed new light on both the cuticula and pocket development.

After the calcification of enamel is completed, Gottlieb[23] conceives the process of eruption about as follows: The inner enamel epithelium lays down a covering over the ends of the enamel rods which he has called the primary enamel cuticula. As soon as this is completely developed, the ameloblasts, the stratum intermedium and the enamel pulp disappear. This occurs just previous to eruption so that, at the time of eruption, the outer enamel epithelium overlies directly the "primary cuticula." These two structures are organically united, with no space intervening. As the eruption stage is reached, the outer enamel epithelium approaches the mouth epithelium, and the intervening con-

16. In our work, we are adopting the term "cuticula dentis." Gottlieb has employed this designation for his "secondary cuticle" only; viz., the portion derived from the enamel epithelium, and has divided it into a crown and root portion. Weski's "epithelial cuticula" is not at all undesirable, though the term "epithelial" may be somewhat misleading. The cuticula behaves as a single structure, whether the material making up this structure is derived from two sources or not. If division is desirable, we see no objection to designating these as "primary and secondary layers." Since there exists some doubt as to the genesis of this structure, we prefer to term it "cuticula dentis."

17. Gottlieb, Bernhard: Etiology and Prophylaxis of Dental Caries, Ztschr. f. Stomatol., No. 3, 1921.

18. Nasmyth: Three Memoirs on the Development and Structure of the Teeth and Epithelium, 1841.

19. Tomes, John: Nasmyth's Membrane. (Lectures on Dental Physiology and Surgery, 1848.)

20. Tomes, Charles: Nasmyth's Membrane, in Tomes' Dental Anatomy, Ed. 1, 1876.

21. Kolliker: Histology of Man, Vol. 3, 1902.

22. Kolliker: Human Microscopic Anatomy (Huxley translation), 1854, pp. 789-794.

23. Gottlieb, Bernhard: Normal and Pathologic Anatomy of the Investing Tissues, to be published.

nective tissue as well as the enamel and mouth epithelium undergo preliminary changes. The inner epithelium overlying the tip becomes cornified and the mouth epithelium thins out. Ultimately, the two approximate each other and unite. As the tooth erupts, because of the complete organic union between the enamel epithelium and the cuticula, the cuticula has but two alternatives, to remain attached either to the enamel or to the enamel epithelium. The connection between the cuticula and the enamel is apparently the stronger, for the cuticula separates from the enamel epithelium. At this instance, Gottlieb describes another structure which he has called the secondary enamel cuticula. He believes that the cells of the enamel epithelium next to the primary cuticula become cornified and detach themselves from the enamel epithelium. These two layers, which he calls primary and secondary cuticula, constitute what is commonly known and described as the enamel cuticle. As eruption proceeds,

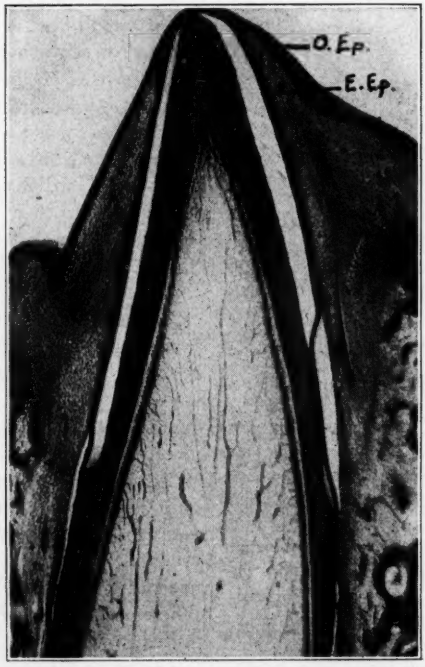

Fig. 1.—Deciduous tooth of pig at stage of eruption when oral and enamel epithelium fuse. *O.Ep.*, oral epithelium; *E.Ep.*, enamel epithelium. In the photomicrographs here shown the following abbreviations are used: *C.D.*, cuticula dentis; *C.E.*, cemento-enamel junction; *P.*, pocket; P^1,$P.^2$ depth of pocket; *O.Ep.*, oral epithelium; *E.Ep.*, enamel epithelium; *A.*, ameloblast; *O.E.Ep.*, outer enamel epithelium; *E.*, enamel; *G.*, gingiva.

separation extends gingivally, the deepest point of separation being the bottom of the pocket. This process constitutes the development of the physiologic pocket. Gottlieb recognizes no physiologic rest period in this separation process. He believes that eruption of the crown varies not only with different teeth of the same mouth, but also with the different surfaces of the same tooth. There is no time at which the eruption reaches the cemento-enamel junction simultaneously. At the time the tooth reaches the line of occlusion, the "clinical crown"[24] is about one half erupted. Between the ages of 20 and 30, the "clinical crown" and the "anatomic

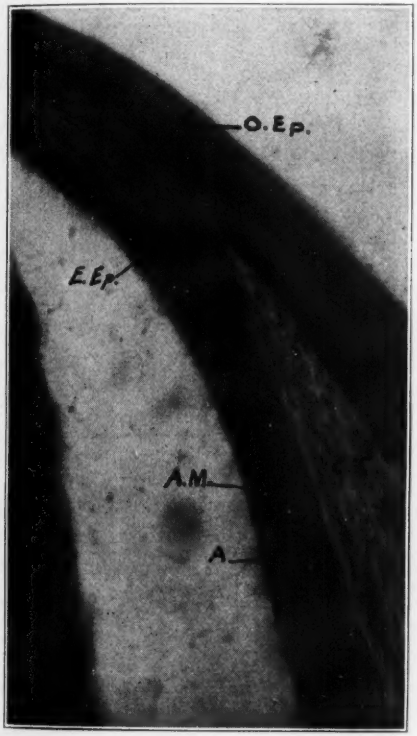

Fig. 2.—Magnification of tip of tooth shown in Figure 1. *O.Ep.*, oral epithelium; *E.Ep.*, enamel epithelium; *C.T.*, connective tissue; *A.M.*, ameloblastic membrane; *A.*, ameloblasts.

Fig. 3.—Deciduous tooth of pig in later stage of eruption than shown in Figure 1. *C.D.*, cuticula dentis; *E.*, enamel; *C.G.*, crest of gingiva; *O.Ep.*, oral epithelium; *E.Ep.*, enamel epithelium. There is no pocket.

24. Introduced by Gottlieb (Footnote 4). By "anatomic crown," he obviously means the enamel covered portion of the tooth; by "clinical crown," that portion of the tooth above the lowest point of separation. This may be smaller or larger than the antomic crown.

crown" are about the same. It is difficult to quote Gottlieb on what he believes constitutes the completion of the process of eruption. His critics, Neuwirth[8] and Römer,[7] prefer to state that he considers eruption a physiologic procedure that has its beginning with the breaking through of the tip of the tooth and is completed only after the tooth is eliminated. This criticism, Gottlieb[5] has emphatically denied. He does believe in a sort of continuous eruption process which recognizes no physiologic stopping point, in which progressive and regressive changes blend into each other.

Subsequent to Gottlieb,[1] Weski[10] was the first to duplicate the study of the cuticula and the pocket. Contrary to Gottlieb, he believes that when the tooth has broken through, the separation that results between the epithelium and the ameloblastic cuticula is a tear. According to his belief, therefore, the pocket represents an "intra-epithelial tear." Weski further believes that the tooth is fully erupted after it reaches the line of

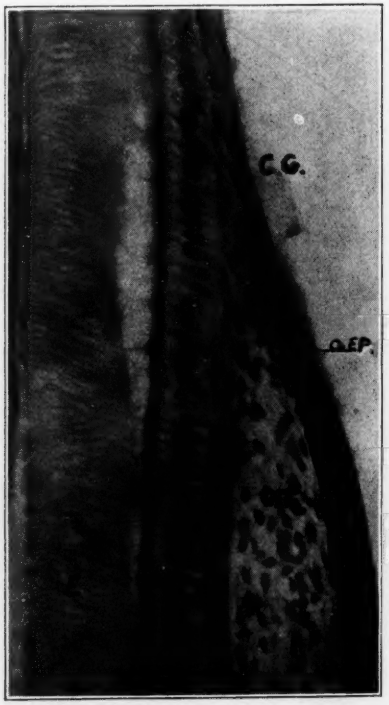

Fig. 4.—Magnification of Figure 2. *C.G.*, crest of gingiva; *O.Ep.*, oral epithelium; *C.T.*, connective tissue; *E.Ep.*, enamel epithelium; *E.*, enamel.

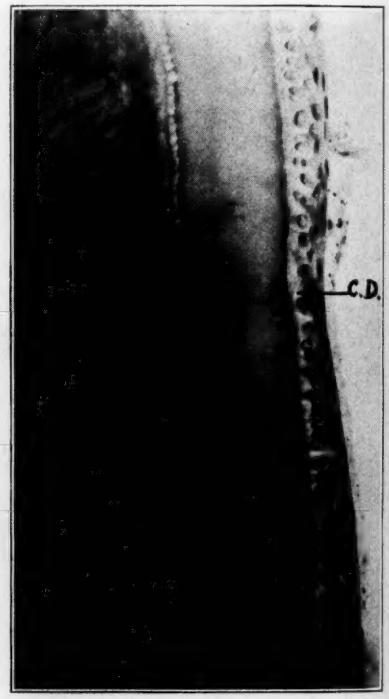

Fig. 5.—Magnification of Figure 2 farther toward the incisal than in Figure 4. *E.*, enamel; *C.D.*, cuticula dentis.

occlusion, that the pocket is 1.5 mm. in depth, and that the bottom of the pocket is found at the cemento-enamel junction. Weski regards the cuticula as a secretory product of the ameloblasts which has adhering to it some fragments

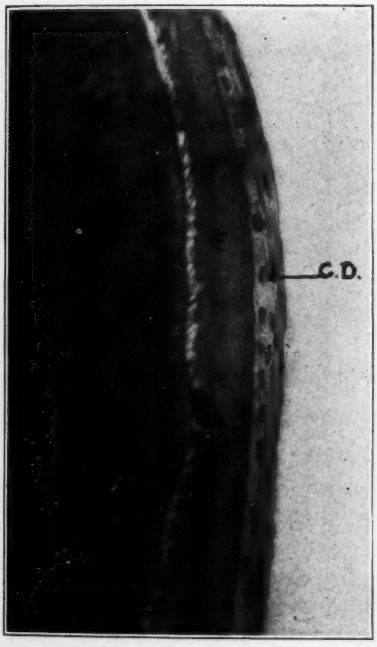

Fig. 6.—Magnification near incisal edge of Figure 2. *E.*, enamel; *C.D.*, cuticula dentis.

of epithelium. Gottlieb believes it to be an exfoliation product. Because Weski has been unable to stain what Gottlieb has called the secondary enamel cuticula with what he considers specific cornified epithelial stain (Gram, thionin, Mallory) he denies that there exists any cornification of the inner enamel epithelium. Lund[12] has also alined himself with Weski on this point. Orban and Koehler[6] refer to the work of Unna and Godolitz, who state that there exists no specific chemical, nor staining test, for cornification. They have described at least four different types of cornification: "keratin A,B,C" and "hornalbumen." The only chemical test remotely reliable is resistance against

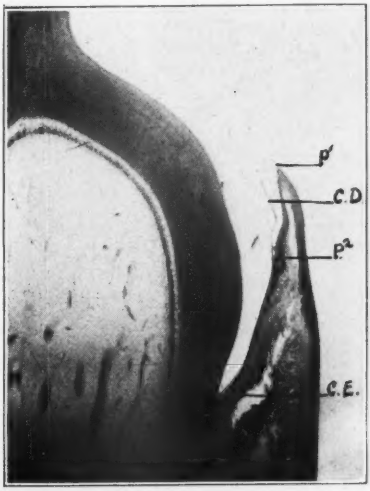

Fig. 7.—Permanent tooth of dog. *C.D.*, cuticula dentis; P^1 to P^2, pocket; *C.E.*, cemento-enamel junction. The character of the cuticula dentis is shown in Figure 8.

dissolution in acids and alkalis. The cuticula resists both of these.

Following the work of Gottlieb and Weski, two opposing factions with an intermediate group developed. Of the intermediate group, best represented by Römer,[7] Neuwirth[8] and Norberg,[9] Neuwirth most adequately expounds the intermediate cause. He states that there is only one enamel membrane, and that it is the concomitant of the act of eruption, because he has been unable to

demonstrate it in unerupted teeth. This membrane is derived from the inner layer of the enamel epithelium, which consists largely of transformation products of the ameloblastic layer. He does not speak of cornification, but describes those changes with such terms as "regressive, homogeneous and atrophic zones." He does not accept the hypothesis of Gottlieb of the two layered cuticula. He states that, when the tooth reaches the line of occlusion, the act of eruption is completed. At that time, the bottom of the pocket is not yet at the cemento-enamel junction. Thereafter, in ideal conditions, a physiologic rest period sets in, which varies with different individuals and in different teeth of the same individual.

The material at our disposal was largely obtained from pigs and dogs, with some from sheep. We have succeeded in demonstrating with photomicrographs many of the developmental phases referred to and illustrated in the literature. Our interpretations and findings vary somewhat from those found in the literature. Conditions vary; materials from different animals vary; so it is not at all surprising to find inter-

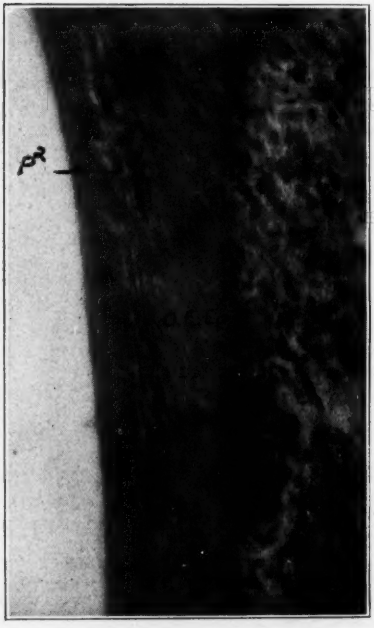

Fig. 8.—Magnification of Figure 7 at and below P^2, the bottom of the pocket. *A.*, ameloblasts; *O.E.Ep.*, outer enamel epithelium; *C.T.*, connective tissue. This tooth was in occlusion with its opponent.

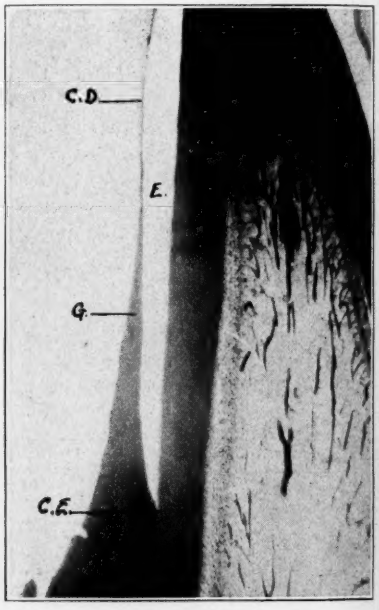

Fig. 9.—Deciduous tooth of pig in occlusion with its opponent. *G.*, the gingiva continuous with *C.D.*, the cuticula dentis. *C.E.*, cemento-enamel junction; *E.*, enamel space.

pretations varying. We believe that interpretations of some of the findings are extremely difficult and even impossible. This difficulty largely accounts for existing differences of opinion. The cuticula dentis does not always have the same structure, nor does it follow the same method of separation from the gingivae to form the gingival pocket; neither is the pocket always present.

We have found, in both the pig and the dog, but little change in the enamel organ or the oral epithelium up to the time the tooth has passed through the oral epithelium and the two epithelial layers have become fused. Principally, the only change observable is in the shape of the ameloblasts. Figure 1, with its higher magnification, and Figure 2 taken from the erupting tooth of the pig, illustrate this. So also does Figure 3 (pig), and its higher magnification, Figures 4 and 5, and, to a certain extent, Figures 7 and 8 (dog).

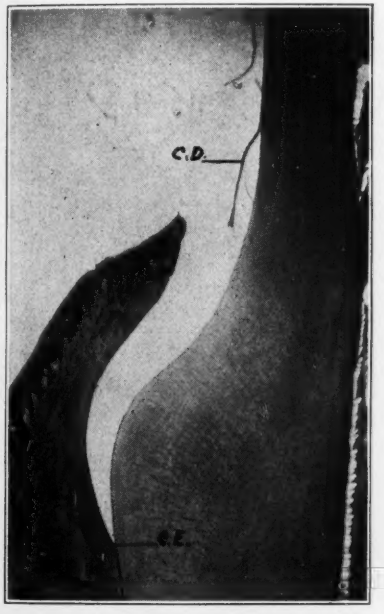

Fig. 10.—Permanent tooth of dog. *C.D.*, cuticula dentis, broken in preparation from crest of gingiva. There is no pocket. *C.E.*, cemento-enamel junction.

Fig. 11.—Magnification of cuticula dentis shown in Figure 10. Nuclei are only faintly discernible.

After the tooth has passed through the oral epithelium, the characteristic form of the enamel organ below the point at which the former has fused with the latter is retained for a relatively long time. This is shown by Figures 7 and 8, from a fully erupted tooth of the dog. The ameloblastic layer is still distinct. Above the point of union

of enamel and oral epithelium, changes take place rapidly, although gradually, giving rise to the cuticula dentis over the exposed portion of the crown.

Figures 4, 5 and 6 illustrate the early changes which occur in the pig. Similar

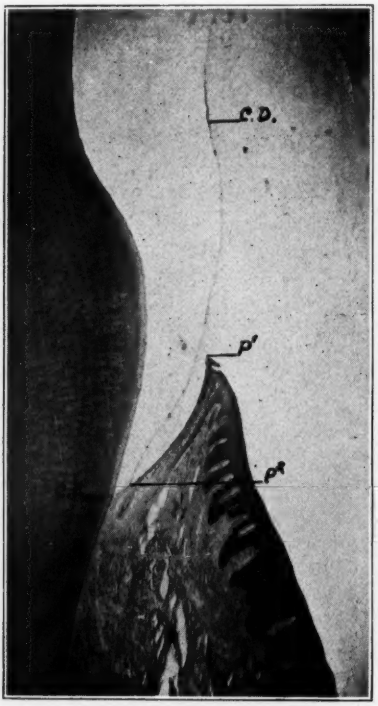

Fig. 12.—Permanent tooth of dog. *C.D.*, very delicate cuticula dentis, believed to consist of the ameloblastic membrane. Separation has formed a pocket from P^1 to $P.^2$ *C.E.*, cemento-enamel junction.

changes in the dog have not as yet been obtained. Figure 4 shows the point at which the oral epithelium has fused and apparently become continuous with the external enamel epithelium. The latter is somewhat compressed, but nuclear definition is perfect. The inner enamel epithelium (the ameloblastic layer) appears only slightly changed, principally in the shape and arrangement of the cells. Further, incisally (Fig. 5), still more compression of the tissues and nuclear indefiniteness is noticeable. There seems to be some desquamation of the surface layers. These changes be-

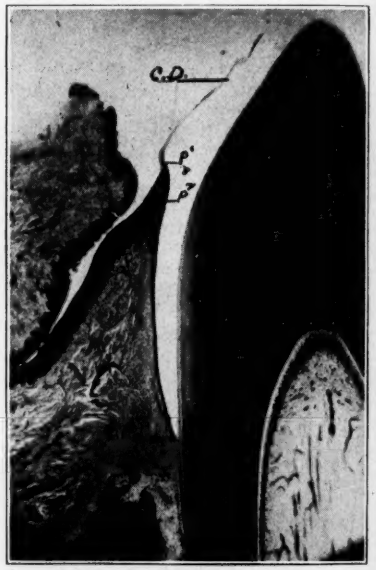

Fig. 13.—Permanent tooth of dog not quite in occlusion. Separation of the cuticula dentis *C.D.* appears to have just begun forming pocket from P^1 *to* P^2. (Compare Figure 14.) *C.E.*, cemento-enamel junction.

come more noticeable still further incisally (Fig. 6). All layers have become more compressed and nuclei are much less distinct, finally becoming, in the fully erupted tooth, entirely lost (Fig. 9). The hiatus which occurs between Figures 3 and 6 is somewhat bridged by Figures 10 and 11, which

are from a fully erupted permanent tooth of the dog. This shows a cuticula dentis, similar in character to that in Figure 6. Nuclei are more indistinct, and the whole structure appears to be keratinized. These facts would make it appear that the cuticula dentis may consist, for a time at least, of the ameloblastic membrane, the ameloblastic layer and some of the fused external enamel and oral epithelium, all greatly altered in appearance from compression and keratinization. We believe that most of the cellular layer is lost, sooner or later, through desquamation. Such a process might possibly leave then, as the cuticula dentis, only the ameloblastic membrane. Only on such basis does it seem possible to account for the appearance of the cuticula dentis in Figures 9, 12 and 13. This is the more usual appearance of the cuticula dentis both above and below the crest of the gingivae, although, in the latter position, a more or less complete cellular layer may make its appearance.

Fig. 14.—Magnification of approximately the pocket in Figure 13. *C.D.*, cuticula dentis, appears to consist of the ameloblastic membrane and one irregular layer of cells.

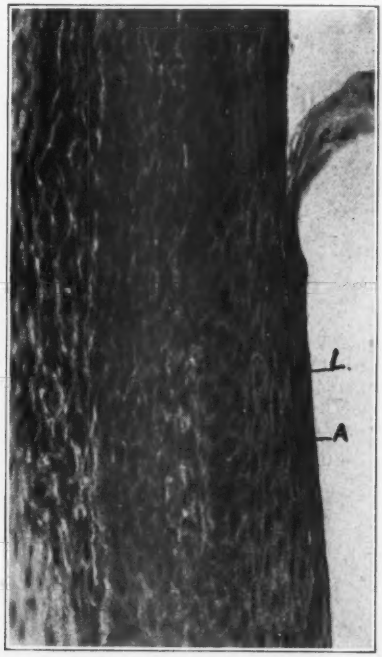

Fig. 15.—Section showing the line at *L*, along which the cuticula dentis, *C.D.*, is separating from the gingival epithelium. *A*, believed to represent the ameloblastic membrane.

In Figures 7 and 8, the separating cuticula appears to consist of the amelo-

blastic layer, and, we may presume, the ameloblastic membrane. In Figure 15, where the separation has extended one third the distance to the enamel-cemental junction, the cuticula apparently consists of one or more layers of cells. The line of separation is quite distinct.

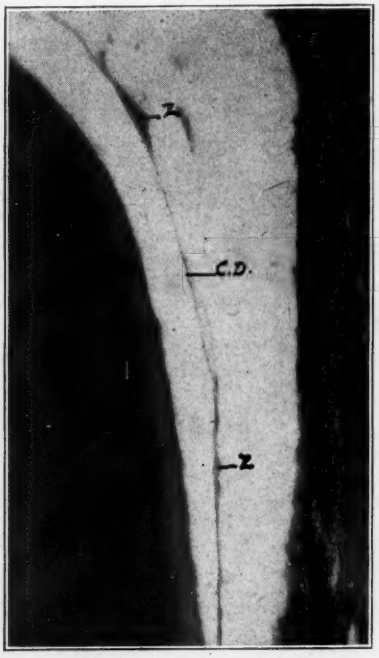

Fig. 16.—A cuticula dentis, *C.D.*, believed to consist of the ameloblastic membrane with clumps of cells, *Z*, adhering to it.

In Figures 13 and 14, the separating cuticula, on the whole, is thinner, apparently consisting of the ameloblastic membrane and one rather discontinuous layer of cells. Such an arrangement is also discernible in Figures 16 and 17; while, in Figure 12, only the ameloblastic membrane appears. Similar conditions may also be found frequently in cases in which a pathologic process is present. (Compare Figure 18.)

It would seem, therefore, that, in the dog, very frequently the cuticula dentis consists only of the ameloblastic membrane. This structure, then, would constitute the "primary" cuticula dentis.

Fig. 17.—Permanent tooth of dog in full occlusion. *C.D.*, cuticula dentis adhering to enamel remains, *E.P.*, bottom of pocket.

Cellular layers, when present, would constitute then the "secondary" cuticula dentis. At times, it appears that the cuticula dentis is a double layered structure and then consists of both primary and secondary cuticula. In other words, the primary is always present, but the secondary may sometimes be absent.

The mode of separation, whether one

of a purely physiologic nature, or one of a traumatic nature, may have some influence on the character of the cuticula. The separation may, in effect, be a tear, and result in a somewhat irregular appearing cuticula such as is illustrated in Figures 14, 16 and 20. The latter figure, obviously, illustrates a tear, but whether an artefact or not, it is difficult to determine. More important are the

Fig. 18.—Interproximal gingiva of adult dog with pathologic condition present. *C*, calculus; *C.D.*, cuticula dentis. Pockets, extending from P^1 to $P,^2$ are of unequal depth. *C.E.*, cemento-enamel junction.

results which may arise from a separation which, to all effects, is a tear. In the dog, the lodgment of foreign bodies in the gingivae (Fig. 24) frequently gives rise to such separation. These features have already been discussed and will not be further referred to here.

Under physiologic conditions, the formation of the pocket is a slow and gradual process. Just when its formation begins or ends, we do not know. We have observed an absence of the pocket in the fully erupted deciduous tooth of the pig (Fig. 9), and in the fully erupted permanent tooth of the dog (Figs. 10 and 21). The beginning pocket has been observed in the

Fig. 19.—Permanent tooth of dog in occlusion. The pocket extends less than half the distance between the crest of the gingiva at P^1 and the cemento-enamel junction at *C.E.* P^2, bottom of pocket. *C.D.*, cuticula dentis.

absorbing deciduous tooth of the dog (Fig. 22) and in the fully erupted permanent tooth of the same animal (Figs. 13, 14 and 19). Intermediate stages are quite common, and may be seen even in the presence of disease (Fig. 18) in permanent and deciduous

teeth down to the time when separation has reached and even extended beyond the cemento-enamel junction. It is always quite difficult to determine just when a separation may be considered as having existed *in vivo* or developed in preparation. For examples, Figures 7,

Fig. 20.—Magnification of labial surface of Figure 19.

12, 14, 17 and 23 might well be considered artefacts. The facts do indicate that, at some time, in the earlier stages of eruption at least, no pocket existed.

In an attempt to form a working hypothesis upon the basis of this material, one is immediately confronted with practical questions pertaining to normal pocket depth or rate of eruption, or as to whether a pocket or no pocket is the physiologic normal. Since we know that there exists no case of paradental

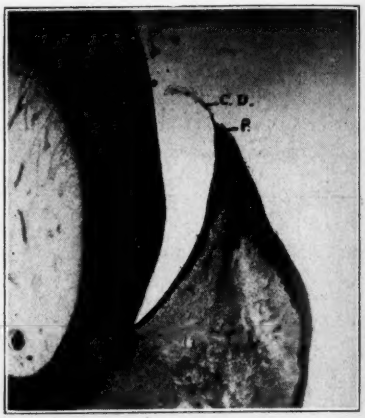

Fig. 21.—Permanent tooth of dog in occlusion. Pocket practically zero. *C.D.* cuticula dentis.

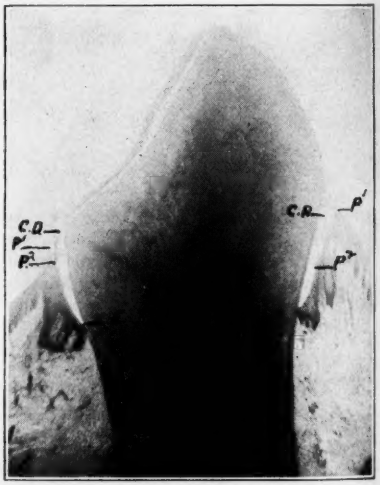

Fig. 22.—Absorbing deciduous tooth of dog. The pocket extends from P^1 to P^2. *C.E.*, cemento-enamel junction. *C.D.*, cuticula dentis.

pyorrhea without a pocket, it is essential that we know what constitutes the difference between a physiologic and a pathologic pocket.

Orban and Koehler, in an elaborate study of human material, have compiled some statistics that give us a basis for an answer to these questions. Of

Fig. 23.—Permanent tooth of dog in occlusion. The pocket extends from P^1 to $P.^2$ *C.E.*, cemento-enamel junction. *C.D.*, cuticula dentis adhering to enamel remains, *E.*

356 normal pockets measured, 45 per cent were less than 0.5 mm. in depth; 29 per cent between 0.5 and 1 mm., and 26 per cent over 1 mm. Fifteen of the 356 showed no pocket. Gottlieb has stated that the physiologic ideal may be 0, and that the pocket is a variation from the ideal. Certain it is that,

Fig. 24.—Permanent tooth of dog. Cuticula formed by a foreign body embedding itself in epithelium of gingiva.

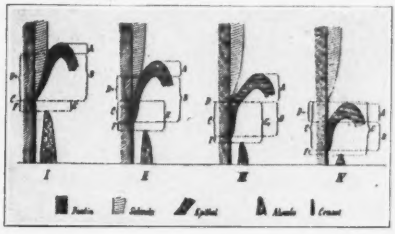

Fig. 25.—Chart reproduced from Orban and Koehler. *A*, depth of pocket; *B*, length of epithelial attachment; *C*, distance between cemento-enamel junction and deepest point of the epithelial attachment; *D*, distance between cemento-enamel junction and bottom of the pocket; *E*, distance between cemento-enamel junction and crest of the alveolar process; *F*, distance between deepest point of epithelial attachment and crest of alveolar process.

normally, we find pockets. He, therefore, differentiates, theoretically, between a physiologically ideal and a physiologically normal condition. Upon the basis of the findings of Orban and Koehler, the average pocket is less than 1 mm. in depth.

As to the rate of eruption, we again refer to Orban and Koehler. We have reproduced their chart (Fig. 25). This brings out their impression of the order of changes. Diagram I represents the condition of a youthful tooth; Diagram II, the same tooth a little further advanced in its eruption, a stage which may be found anywhere between the time the tooth has reached the line of occlusion and the age of 30. Diagram III illustrates the eruption as we used to visualize it, viz., the bottom of the pocket is now located at the cemento-enamel junction. This state of affairs is found at about the age of 30, instead of, as formerly believed, immediately after the tooth had broken through. Diagram IV represents a still more advanced stage. The root surfaces are exposed, and the bottom of the pocket is well beyond the cemento-enamel junction.

CONCLUSIONS

Upon the basis of our study of the literature and of our own work, we have come to the following conclusions:

1. Under physiologically ideal conditions, we believe the pocket depth of 0 mm. is the ideal.

2. The ordinary functioning of the mouth, in the vast majority of instances, brings about a change from this ideal condition so that a pocket is developed. A pocket, therefore, must be regarded as the physiologic normal.

3. The pocket is developed as the tooth erupts, by a separation between the enamel epithelium and the cuticula dentis.

4. The cuticula dentis appears to be formed in any of the following ways: from the ameloblastic membrane only; from the ameloblastic membrane and the ameloblastic cells, or from a combination of the preceding two with one or more layers of inner enamel epithelium.

DENTAL HYGIENE AS CONDITIONED BY DEVELOPMENT OF THE TEETH*

By RICHARD ARTHUR BOLT,† M.D., D.P.H., Berkeley, California

MODERN dental research, while contributing substantially to our detailed knowledge of tooth structure and the processes leading to malocclusion and caries, has by no means simplified problems of dental prophylaxis. Such happy formulas as "a clean tooth never decays" and "a vegetarian diet assures sound teeth" no longer suffice as slogans in our dental hygiene program. We now know that sound teeth depend on many factors—hereditary, congenital, environmental, nutritional, etc.—some of which are very puzzling and complex, others relatively simple. More progress has been made in technical skill for the restoration and correction of defective teeth than in the prevention of malformations and early dental decay. Dentistry, just as medicine, until quite recently has been much more interested in pathology than in physiology and hygiene. However, the era of preventive dentistry has arrived, and progressive dentists the world over are now seeking the best ways and means of preserving normal development of the teeth and of preventing many defects to which teeth are prone. These dentists are most enthusiastic advocates of modern health education, which, of course, must include oral hygiene.

The foresight of some of the early pioneers in the study of the teeth was really remarkable, considering the crude instruments in their hands. While Aristotle and Hippocrates wrote incidentally about the teeth, and Versalius, in 1543, described them, with his observations of the teeth of sheep and the ass, as a basis, it is to Eustachius that credit is due for giving the first fairly accurate description of the development of human teeth, in his "Tractus de Dentibus," published in 1562. An outstanding classic in this field is John Hunter's "Natural History of the Human Teeth: Explaining their Structure, Use, Formation, Growth and Diseases," the second edition of which appeared in 1778, although the material used was based upon observations made by Hunter before 1755. Joseph Fox, in 1803, published his "Natural History of the Human Teeth, including a Particular Elucidation of the Changes which take place during the Second Dentition and describing the proper mode of treatment to prevent irregularities of the teeth, to which is added An Account of the Diseases which affect children during the first dentition." Fox recognized that "when the fetus has advanced so far, in the organization

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of its different parts, as to take some determinate form or figure, we may perceive a considerable progress, in the preparatory steps, for the formation of the teeth." He further noted that "the preservation of the teeth during the continuance of life is very much affected by the care which has been bestowed upon them during the earliest periods."

The first attempts at artificial production of caries were probably those of E. Magitot, the results of which were reported in his "Traite de la carie dentaire" published in Paris in 1867. He believed that caries is "a purely chemical alteration exercised on the enamel and dentine of the teeth, either by the products of acid fermentation in the saliva or by active substances introduced directly into the mouth." The next work of note was that of Milles and Underwood, which probably stimulated the epoch-making contributions of Miller.

The careful and exhaustive studies of Miller into the flora of the mouth and their relation to fermentative changes, with dissolution of enamel and dentin, left little to be demonstrated along this line. Recently, Bunting has reviewed the work of Miller and others, and comes to the conclusion that "our present-day conception of dental caries is not materially changed from the views of W. D. Miller, who, in 1882, described the initial process as a decalcification of the enamel by acids produced in the fermentation of carbohydrates contiguous to the surface of the tooth." Bunting states further that "*B. acidophilus* is present in every initial lesion of dental caries. It is also an inhabitant of a small percentage of mouths in which there is no dental caries."

The painstaking studies of Sir Charles Tomes, incorporated in his excellent "Manual of Dental Anatomy—Human and Comparative," deserves mention here. Our knowledge of enamel structure has been further enlarged by the work of J. Leon Williams, Hopewell-Smith, von Beust, Guido Fisher and Caush, as well as by the exhaustive histologic studies of Walkhoff. Mummery has well summed up the work of these and other investigators in his second edition of "The Microscopic and General Anatomy of the Teeth," and in his report to the Medical Research Council of Great Britain on "The Structure of Teeth in Relation to Dental Disease." Much of the recent work has centered on the relation of nutrition to the development of the dental structure. In this connection, the researches of McCollum and Grieves, Percy R. Howe, Shipley, Sherman and, in England, of Mellanby are of special note. The endocrine factor has also received considerable attention in the hands of Broderick and others. It is not possible, in the brief scope of this paper, to mention all the important workers in this field. Suffice it to show that a considerable amount of experimental work is now going forward that promises to clear up some of the doubtful points and give us a more solid basis for our mouth hygiene program.

Since the time of Miller, more study has probably been put on the rôle of micro-organisms in the causation of caries than on any other phase of dental investigation. There is still considerable difference of opinion as to whether organisms play a primary or secondary part in dental decay. The conclusion of Miller, twenty years ago, holds good today "that the enamel of the teeth of different persons as well as of different

teeth of the same person and of different parts of the same teeth does show differences in resistance to the action of acids." In commenting on this statement, Mummery affirms that "there is no one all-predominating factor which accounts for immunity or susceptibility to caries, but a large number of factors, part of which are to be sought for in the teeth themselves and part in their surroundings. So too, the resistance of the enamel is only one of those factors, and its importance will be found to vary greatly in different cases."

The influence of the endocrine organs on dental defects and hypoplasia has received considerable attention during recent years. While it is reasonable to suppose that dysfunction of these glands may exert unfavorable influence on the development of the teeth, the controlled experimental evidence is scanty and not altogether conclusive. It must be stated that a number of cases have been reported in which there appeared to be some disturbance of the thyroid, parathyroids or pituitary and these individuals suffered from definite dental defects. It is well known that cretins are very apt to have deformed or decayed teeth.

In the final analysis, the structure of the tooth itself largely determines its resistance to mechanical and chemical forces as well as its physiologic adaptation to the processes of mastication. Whatever may be the exciting causes of dental decay and malocclusion, there is no question that tooth structure is a key to many problems for which we are now seeking solution. It is futile to apply surface remedies when the real difficulty lies at the very foundation. It is shortsighted to wait until damage is actually done and then attempt, by patchwork or pulling, to correct a condition the cause of which lies in the innermost structure of the teeth. Dental decay and malocclusion are not simple processes. The basic conditions lie far back in the germ plasm and in the early development of the teeth.

No adequate knowledge of structure is possible without consideration of the development of the teeth from their very beginnings. It is now well recognized that a considerable percentage of tooth defects are developmental and that the underlying condition existed weeks or months before the teeth erupted. Walkhoff, after a careful histologic study of teeth, concluded that "there is scarcely a tooth of civilized man, in which one cannot find some defect of structure in the development of its elements, either in their size and arrangement or in regard to their calcification." This observation has been confirmed by a number of other investigators, and may be accepted as a settled conclusion.

The same, or correlated, forces that condition the growth and development of other organs must play a prominent rôle in the development of the teeth and their supporting structures. While teeth are frequently compared to bony structures, it should be recalled that they arise quite independently of, and antecedently to, the endoskeleton. It is also well to bear in mind that teeth are derived from both ectoderm and mesoderm and are attached only secondarily to the alveolar process. Furthermore, the material of which teeth are composed is derived ultimately from the food. In the fetus and nursling, this food is ingested by the mother or comes from her body stores. There is no other conceivable source until the infant begins to take food for itself from the surrounding

environment. The influence of maternal nutrition on the developing teeth is, therefore, of paramount importance, as already indicated by our newer knowledge of nutrition.

We begin to appreciate the importance of constitutional factors and maternal nutrition when we consider that as early as from the thirty-fifth to fortieth day of intra-uterine life, the anlages of the teeth make their appearance, and from then on, there is a gradual development and differentiation of dental structures, the first traces of calcification showing at about the twentieth week. Mummery states that "at birth the sacs of the first permanent molars and those of all the temporary teeth are fully formed, the crowns of the temporary incisors are calcified and the tip of the canine and the separately formed cusps of the two temporary molars are united. One cusp of the first permanent molar is calcified and seen as a minute triangle." Calcification continues throughout infancy and preschool life and the early school years. It does not require great strain on the imagination, therefore, to conceive that any unfavorable influences, such as poor nutrition, organic or inorganic poisonings and toxins from infectious disease of the mother, may seriously affect the delicate developing teeth and hence lay the foundation for defects that later manifest themselves.

Another matter of considerable interest in the early development of the teeth is the fact that the first permanent molars are related closely to the deciduous teeth, being formed from a prolongation of the dental lamina which gives rise to the primary dentition. This may have some bearing on the hygiene of the first permanent molars when they erupt. The dental lamina forms the epithelial connections with the developing teeth. These connections gradually disappear and, at birth, the bands to the incisor teeth have almost disappeared, while those to the first and second molars persist. At this stage of development, defects are quite liable to occur. As Mummery points out, in the "process of breaking up and absorption of the tooth-band between the forming enamel germs, remnants of this epithelial lamina may persist, and give rise to such irregularities as supernumerary teeth, odontomes, etc., other portions becoming degenerated and not absorbed, giving rise to such abnormal structures as cysts and epithelial pearls." Less noticeable defects may also occur which pave the way for deformities or caries after the teeth have erupted.

While our knowledge of enamel and dentin is still incomplete, we do know that, by the time the child is ready to enter school, calcification of both temporary and permanent teeth is almost finished. Any preventive efforts, to be effective, must have been made before that time, at least, as far as developmental defects and laying down of enamel is concerned. Calcium salts must have been derived from the food or tissues of the mother during pregnancy and lactation and from the child's food during the preschool period. Our attention should therefore be turned to the metabolism of calcium to understand what takes place at this time. It has been demonstrated that there must be a proper balance between calcium and potassium salts in the circulating blood to maintain normal metabolism. While the amount of calcium must be adequate to the demands, it is necessary to provide it in balanced relationship to potassium.

This is most fully assured by including ample quantities of milk in the dietary. It has been conclusively shown that, where there is small calcium intake, as among peoples living where milk is not readily available, small skeletal development results.

There must also be some fixing mechanism in the body for the proper disposition of the calcium. Whether this takes place through the stimulus of some harmone or secretion from the ductless glands, is dependent on one or more of the vitamins or is largely a chemicophysical process is still an open question. Regardless of the exact mechanism, the practical conclusion faces us that the dietary of the mother must be adequate, and balanced, and must contain the essential vitamins and inorganic salts. Some interesting and suggestive work has recently been carried out which indicates that the developing teeth may suffer hypoplasia or inhibition of growth with defective calcium deposit as the result of dietary deficiencies. Similar changes in the teeth have been noted in children who had suffered from one of the exanthems during infancy. Whatever the ultimate causes underlying defective or hypoplastic enamel, we know that such defects are common. Many dentists believe that these defects provide a nidus for bacterial growth and fermentative processes, which eventually bring about a dissolution of the enamel with caries.

It would seem that, with the thorough microchemical and histologic examinations to which enamel has been submitted, there would be a consensus of opinion as to its fundamental structure and reaction to environmental factors. The investigations, however, are beset with considerable technical difficulties. There are two main contentions; one, championed by Tomes, that enamel contains no organic material and when once formed can be altered only by mechanical or chemical agents; the other, represented by Mummery and others, who claim that careful histologic examination reveals the presence of minute spaces between the enamel rods, reaching from the dentin border to the surface of the enamel, which make possible subsequent changes and dissolution of the enamel. A middle ground may be taken if one accepts Williams' view that the intercellular substance in normal teeth is thoroughly calcified and leaves but little room for future organic changes, as but few teeth are perfectly normal and spaces may be left that make possible absorption of acid products and the entrance of bacteria. All are agreed that fully formed enamel contains a much smaller percentage of organic material than was formerly supposed, and, further, that perfectly developed teeth, with thorough calcification, would be subject to but little change in their oral environment.

Summing up our present-day knowledge, we may state that dental hygiene is, of necessity, conditioned by the early development of the teeth and the conditions to which they are exposed during growth. The prevention of dental caries and the development of proper dental occlusion depend on many factors, some of which have not been fully elucidated. With the knowledge at our command, certain practical considerations may be given to the following in our dental health education program:

1. The prospective mother should be given every attention that modern prenatal service demands. This includes not only skilled medical and nursing

care but prophylactic dental advice and service as well. Special attention must be given the dietary, to see that it is ample, well balanced and includes sufficient amounts of the accessory food substances and proper proportions of calcium and potassium salts, iodin and iron. As long as the infant is dependent on the mother for its basic building materials, the diet of the mother must receive first consideration.

2. The pregnant woman should be afforded every protective measure against the infectious diseases that modern preventive medicine has to offer. This will include immunization against smallpox, typhoid fever and diphtheria. Foci of infection, whether in the teeth, accessory sinuses, appendix or elsewhere, should be cleared up as early as possible. The time is at hand when the obstetrician is remiss in his responsibilities if he does not examine his patient thoroughly for specific disease and institute intensive treatment when disease is found.

3. Constitutional diseases on the part of the prospective mother undoubtedly have a deleterious effect on the developing fetus and should always be carefully investigated. We have in our hands definite measures for the treatment of diabetes and certain other of the glandular dysfunctions.

4. Protection should be afforded against the industrial poisonings, against harmful drug habits and against undue fatigue.

5. While development of the teeth is well under way at birth, there is still time to influence the permanent teeth through proper diet, protection against communicable disease and environmental forces. If the mother is well and on a proper diet, breast feeding is ideal, as it not only makes for greater resistance in the permanent teeth but also assists in preserving the normal contour of the jaws and occlusion of the teeth.

6. After weaning, eternal vigilance in regard to the diet is necessary. The prevention of rickets by the inclusion of antirachitic vitamins in the dietary (cod-liver oil) and by sunlight, and the prevention of scurvy and other nutritional disorders by suitable feeding, will do much toward dental hygiene.

7. Skilled dental attention, including the services of dental hygienists, from the time the first teeth make their appearance until the last permanent molar has erupted is the *sine qua non* of modern dental hygiene. If more dentists recognized the supreme importance of early childhood care of the teeth and knew the prophylactic measures that can be taken, we would have far less dental decay and malformation.

8. While changes in the germinal constitution of the teeth and alteration of fetal structure may still be beyond our control, it is felt that we already possess sufficient knowledge and skill, if conscientiously applied, to prevent many of the defects of the teeth from which children and adults now suffer.

THE EDENTULOUS AND SEMI-EDENTULOUS RIDGE FROM THE RADIOGRAPHIC POINT OF VIEW*

By HOWARD H. JACKSON, D.D.S., Detroit, Michigan

FROM the point of view of the patient, the problems of denture construction are few and simple. All that the patient demands is that the restoration shall appear natural and function properly and that it shall be permanent in tissue adaptation. There is also the hope that there will be a minimum of discomfort during use. It is with the question of determining the permanence of tissue adaptation and comfort that we shall deal. On the other hand, the problems of the prosthodontist are many, and but one of them is to solve the question of unbalanced dentures and the effect that the lack of balance has in producing recession or shrinkage.

A study of dry specimens, together with a study of radiograms of these same specimens and also of similar conditions from actual cases in practice will afford a view of this subject different from that usually held. This study cannot but lead one to the conclusion that no matter how carefully balance has been obtained—in fact, even though there is an entire absence of trauma or uneven stress—recession can occur, not necessarily because of faulty technic or construction, but because the supporting structures are faulty and not fit for the use they are expected to give. I do not say that trauma cannot produce recession, because it does, but many instances of recession that heretofore have been classified as an end result of lack of balance or trauma are primarily due to destructive changes within the supporting tissues and structures.

Heretofore, it has been necessary to depend largely on digital examinations and experience in judging whether or not a ridge will be favorable for denture construction. It is believed that we will present an added method of increased accuracy in differentiating favorable and unfavorable types not only in the postoperative cases but in the preoperative as well. We believe it will also be of value in the determination of localized areas of irritation, which so often cause grief not only to the patient but also to the operator. We mean that these conditions can be determined by correct radiographic interpretations. Before considering the changes of the ridge formations, we should review the characteristics that differentiate a good radiogram from those which are so often presented. The distinguishing marks of a good radiogram are these: There must be a minimum of distortion of length and breadth of the parts under observation; the soft tissue detail must be visible, and a sufficient number of

*Read before the Section on Full Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

exposures must be made to cover all the areas of both arches, including the retromolar spaces and the tuberosities. Minimized distortion requires that the angulation be determined as correctly as possible and that the films be not bent as far as the surfaces on which the parts in question are registered. These factors are the fundamentals of good radiography. Another essential is that the examiner must know the radiographic anatomy so that he may differentiate between normal and abnormal conditions. In interpretation, one must always remember that the radiographic evidence is always less in extent and apparent severity than the actual condition is in reality. The ideal preoperative condition of the teeth and their supporting structures will show the septums with their crests intact and of the proper shape for their position. The first step in destructive influences is the incipient cervical pericementitis which is revealed radiographically by the pinching of the crests and a thickening or enlargement of the pericemental membrane about the cervix. From this point, we note three types of reaction to the irritating factors. The first type results in a recession of the septums with but little or no infiltration into the cancellous structures. This may progress to the apical portions of the roots without a definite infiltration. A condition such as this is favorable for retention of the teeth, if given intelligent treatment, without danger of loss of a satisfactory ridge-form. The second type of recession shows a breaking through of the crests and an infiltration into the cancellous structure which is apparent in the decreased density of these structures. There is normal cancellous structural formation bordering the infiltrated area and, in some cases, the cancellous structures appear more dense as though there was an effort to wall off the invading influences. This type, as a rule, while more destructive than the first, is amenable to correct treatment. The third type is very destructive and apparently requires early and radical treatment if there is to be any hope of permanent ridge form and of comfort in use. After the first evidences of cervical pericementitis are observed, there will be noticed a breaking through of the crests of the septums and an infiltration extending into the cancellous structures comprising the body of the septum. There is no apparent line of demarcation between the infiltrative and normal areas as in the second type. This class of destructive influence is not always accompanied with a corresponding loss of the dura, for we sometimes see infiltration extending well into the medial portions of the septums, with the dura extending to the cervix and the crests but slightly broken through. This infiltrative process can, and frequently does, extend beyond the apices of the teeth. The destructive influences remain after the teeth have been removed unless especial attention has been given by the surgeon to remove the affected structures. This residual infection produces, in turn, continual shrinkage of the ridge and irritation of the soft tissues through expulsion of spiculae.

Another type of destructive influence on ridge-formation is that produced by marginal sacs such as we find in so-called pyorrheal pockets. These sacs contain bacteria such as are found in periapical sacs. Retention of these sacs will apparently produce areas of decreased density in the cortical layer to

such an extent that, in many instances, the cancellous structures are exposed. This is almost synonymous with localized discomfort beneath a denture. Correct interpretation preceding the removal of the teeth would have prevented this particular factor of irritation.

The soft tissue detail will reveal the presence of spiculae within the gingivae which would otherwise be lost to view if these tissues were not shown. We wish to call attention to the peculiarity that the presence of spiculae within the soft tissue of persons in apparently normal health is usually accompanied with no discomfort, and the spiculae are usually absorbed before they reach the surface. Spiculae, in these cases, are most generally found before complete regeneration of the cortical layer has occurred. On the other hand, spiculae within the soft tissues of patients below normal, even though the surgery may have been performed some time previously, will mean areas of localized irritation which cannot be overcome without surgical interference. Localized areas of irritation are distinguished by a roughening of the crest in an otherwise excellent cortical layer.

The radiographic appearance of the desired lower ridge shows a thin, dense cortical layer which has no areas of decreased density within it. This is accompanied by a generous cancellous formation to furnish the necessary support. In the upper arch, the cortical layer is usually less evident, and even though we can determine a reasonably smooth or even ridge, we can consider the cortical layer as desirable or favorable. These conditions are but seldom encountered, and are usually the result of the first type of recession. Using this condition as the ideal, we can demonstrate all degrees of variation from it until an entire absence of the cortical layer is noted. The final stage is distinguished by the loss of the thin white line on the crest and the serrated ridge and exposed unjoined ends of the cancellous structures within the soft tissues. Such conditions are usually associated with pitting or infiltration of the cortical layer bordering the area and are from the second or third types of recession or from retained marginal sacs.

The second or limited infiltrative type can be treated successfully as a rule by mild surgical interference. The tissues can be retracted surgically or by other means until a sufficient view of the affected areas is provided. Then, by the use of chisels or small curets, the sacs and infiltrated bony structures are removed. This procedure has been very successful in the indicated cases when the operator is competent and trained.

At the present time, the only method of combating the third or severely destructive type of infiltration is intelligent surgical interference. The retraction of the soft tissues will reveal to the surgeon pitting or infiltration of the outer plates, and he must proceed to below the line of infiltration. I am not an advocate of nor do I believe in radical surgery without just cause, but, in the lower arch, especially definite infiltration of the cortical layer should automatically indicate removal of these conditions. The lower cortex should present a smooth uninfiltrated surface. The upper arch shows minute foramina which must not be confused with infiltrative conditions. The infiltrative condition should be recognized as early as possible in order that the patient may have as satisfactory a ridge form as it is possible to obtain. Persistence in reten-

tion of the teeth in the destructive infiltrative type will eventually result in loss of all supporting structure and the loosening of the teeth. This is followed with recession of the ridge after the soft tissues have healed, which will apparently respond to no other measures than surgical interference.

A careful consideration of the foregoing will reveal that certain conditions of the septums must be reckoned with from a prosthodontic point of view as well as from those which are usually considered. Further study will lead one inevitably to the conclusion that the cancellous structures are not maintained by, even though they may have been laid in response to, mechanical factors and influence alone. Observation of cases referred by physicians as well as dentists cannot but impress one with the fact that there are factors apparently systemic in nature and about which we at present are entirely in the dark, but which influence, if they do not largely control, the quality of the cancellous structures and cortical layers that form the foundations upon which the success or failure of denture construction depends.

SUMMARY

1. The intra-oral radiogram will afford a greater knowledge of the conditions of the crests of the ridges in the edentulous cases and of the crests of the septums in the preoperative case than will a digital examination.

2. A study of the preoperative case must be made with the especial view of the condition of the crests of the septums and of the cancellous structures in the bodies of the septums in mind.

3. There are, radiographically, three types of recession of the septums. The first is noninfiltrative and is favorable for further treatment and retention of the teeth without interference with a satisfactory ridge form. The second is infiltrative in character but is localized in its effects and may, under proper treatment, be converted into a serviceable ridge form. The third is severely destructive in nature and is unfavorable for proper ridge form if allowed to persist.

4. Loss of ridge form will occur if the bony structures are not favorable even though perfect balance has been obtained in construction of the dentures.

5. The radiographic interpretation of areas such as usually contain marginal sacs is necessary to prevent localized areas of irritation beneath dentures.

6. Examination of the intra-oral radiogram in edentuluos cases will usually reveal generalized or localized areas of decreased density of the cortical layer, which will indicate the cause of discomfort.

7. The soft tissue detail must be apparent radiographically in order to reveal the presence of spiculae, which, under certain conditions, are factors in local or general irritation.

8. The solution of this problem of obtaining satisfactory ridge form lies in correct interpretation of the radiogram and intelligent treatment of the condition revealed.

RADIOGRAPHIC DIAGNOSIS OF DIFFICULT DENTITION*

By CLARENCE O. SIMPSON, M.D., D.D.S., F.A.C.D., St. Louis, Missouri

REFINEMENT in diagnosis is a prominent feature in the present evolution of orthodontics. This is a commendable trend because accuracy in diagnosis is a prerequisite to efficient treatment. Orthodontists have long been noted for their study of occlusion and dynamics, and the consistent use of dental and facial casts for diagnostic purposes, to which has recently been added the gnathostatic mensuration in a search for basic principles. Although all advances in diagnostic facilities should be encouraged and utilized, the primary factor of thoroughly investigating the teeth must not be neglected. Since the individual quota and status of the teeth are the elements which the orthodontist must correlate to adjust abnormalities, as a preliminary step it is essential that dental conditions be ascertained.

An examination of dental conditions for orthodontic purposes should cover not only the exposed surfaces of erupted teeth, but also the roots, the alveolar processes, the maxillae and the mandible, because their consideration may reveal important information. Radiography offers the only available means of extending the investigation to its logical range, and the conclusive advantages of routine radiodontic examinations are proved by a trial. Too generally, the inclination is to restrict radiographic examination to patients with unusual developments, or to employ it only after complications have arisen in treatment. Such negligence is stupid in that factors are ignored which may decisively influence the treatment and prognosis.

The utility of radiography in orthodontics is not confined to determining the presence or absence of unerupted teeth, and the investigation should not be limited to this single objective. When information regarding only one feature is sought the examinations are likely to be so modified and carelessly performed that other pertinent data will be undisclosed. The radiographic revelations intimately associated with the difficult eruption of teeth, and related to orthodontic diagnosis, are:

1. Dental anomalies of number, which produce difficult problems in treatment; and redundancy or deficiency occurs in a sufficient proportion of subjects to demand consideration.

2. Dental anomalies of location, which vary from moderate disarrangements amenable to mechanical eruption if discovered in youth, to those extreme misplacements beyond the alveolar process.

3. Dental anomalies of position, ranging from slight deviations which

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may be corrected by supplying space, to horizontal impactions or complete inversion. The presence of impacted third molars which have been disregarded often causes a relapse of malocclusion after the completion of treatment.

4. Dental anomalies of form, including rudimentary types unfitted for function, and complex formations obstructing dentition.

5. Dental anomalies of development; i. e., premature growth, or arrested development of crowns or roots.

6. Dental anomalies of decalcification and exfoliation, requiring the removal of deciduous teeth to avoid deflection of the successors.

7. Local pathologic processes, including proximal caries, periapical infections and cysts.

8. Osseous characteristics in the form of the facial bones, to supplement photographic records; and the structure of the maxillae and mandible, to calculate physical resistance. In addition to the diagnostic value of radiograms, they supply a preoperative record which can be obtained by no other method. Also, they may be used to illustrate orthodontic appliances in operation; to examine the adjustment of bands, and to observe the results of treatment.

A general radiodontic examination for orthodontic purposes should include twelve intra-oral views, occlusal views of both dental arches, and extra-oral views of both sides of the face. The twelve intra-oral views should be so directed as to have three of the maxillary incisor region, one of the mandibular incisor region, one of each cuspid region and one of each molar region. One occlusal view of the maxillary arch is sufficient unless the accurate localization of unerupted teeth is required. One occlusal view of the mandibular arch will reveal the approximate location of the teeth prior to the eruption of the second molars, but the divergence of the longitudinal axes of the second molars and the incisors necessitate three views in order to project the occlusal aspect of these teeth. The extra-oral views should show the teeth in occlusion and should include the third molar region, as the relative mesiodistal root inclination of the maxillary and mandibular teeth is not easily visualized in intra-oral radiograms or casts, and, in young subjects, the third molar region can rarely be examined intra-orally.

Radiodontic examinations should not only be a routine procedure, but should also be performed systematically in order to obtain dependable evidence. When orthodontists display radiographic records the first of which is made with appliances in position, they demonstrate their negligence in instituting treatment before having the information for diagnosis. The parent or nurse who accompanies the child should be enlisted to assist in the examination by retaining the film packets and immobilizing the head. Regardless of the tractability manifested, the imperfect muscle coordination in young subjects necessitates special precautions to prevent movement during the exposures.

Radiography will assist orthodontists in proportion to the extent it is employed, and the degree of skill exercised in the examinations. Professional obligation in diagnosis and treatment demands the utilization of every available means to promote service, and not the least important of orthodontic aids is the radiographic examination.

ACCIDENTS DURING ADMINISTRATION OF LOCAL ANESTHESIA; TECHNIC FOR REMEDIES*

By LOUIS SCHULTZ, D.D.S., M.D., Chicago, Illinois

THE best remedy for accidents occurring during the administration of local anesthesia is prevention. Various factors enter into this. I shall briefly mention two to make my point clear. Foremost is the necessity of surgical asepsis. Any omission of, or variation in, the well known ritual of asepsis carries with it its penalty and may cause accidents of a most serious nature. Carelessness in asepsis invites disaster. This may range from postoperative soreness, to severe infection, even to a fatal septicemia.

A thorough knowledge of anatomy is probably the next most important factor. This enables the operator to carry the anesthetic agent to the proper spot and along the best route, preventing subsequent disability, such as would follow traumatizing a muscle. Such an operator practically always prefers conductive anesthesia to any other type, although the infiltration method has its place and should be used when indicated.

The dangers in the practice of the art of local anesthesia are due to either technical errors or bad judgment or both. If a proper solution is used and the operator remains within safe limits as far as amount is concerned, toxic symptoms will rarely, if ever, appear. A safe amount, according to Fischer, consists in not to exceed 125 c.c. of a 1 per cent solution of 40 c.c. of a 2 per cent solution of procain at one sitting. In the practice of dentistry, no one need expose a patient to the danger of an overdose.

The presence of infection is another source of danger. If localized, the conductive method of anesthesia is the method par excellence, for, by this method, the anesthetic agent is injected into a normal field and the needle carrying it to place does not penetrate or encroach on the infected area. If the infection is so widespread that these conditions cannot be fulfilled, or if the case is one of generalized infection, a local anesthetic must not be used.

Accidents are likely to happen to patients with cardiovascular disease, especially when accompanied by arteriosclerosis and hypertension. But by managing such cases so as to prevent or allay excitement and by using a solution of procain containing the minimum active amount of epinephrin, the patient's welfare is safeguarded.

An intelligent interpretation of the blood pressure found in such cases is often quite a help. A statement that the patient's systolic pressure is high, let us say 180 mm. of mercury or over, does not convey much information. It is

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

essential that the diastolic pressure also be known in order to determine the pulse pressure and whether or not the three are in normal relation.

In order to be able properly to evaluate any blood pressure findings, it is obviously necessary to know what constitutes the normal. Here we find differences of opinion. One group holds 120 mm. of mercury, systolic, to be the normal through adult life; another that 120 mm. of mercury is normal at 20 years of age and increases five points every decade thereafter. Again: Pulse pressure to diastolic pressure to systolic pressure is as the ratio 1: 2: 3. Others maintain that normal systolic blood pressure in male adults may vary from 105 to 145 mm. of mercury, with a diastolic pressure ranging from 25 to 50 mm. of mercury lower than the systolic. No matter which group makes the strongest appeal, it is apparent that both systolic and diastolic pressures must be known if an opinion of value is to be arrived at. To illustrate: The systolic pressure of an individual may be, say, 130 mm. of mercury—well within the normal—but his diastolic pressure is down to 70, bringing his pulse pressure up to 60, or far above normal. A physical examination combined with a good history confirm the suspicion of athlete's heart. Indeed, a perfectly normal systolic pressure of 120 may be found in cases of aortic regurgitation, especially in the endocarditic group, and the true condition of affairs be realized only when the diastolic pressure of, say 50 shows the great deviation from normal by a resultant pulse pressure of 70, a pressure higher than the diastolic. Again, a systolic pressure of 130 may represent the total power of a failing heart. A diastolic pressure of 110 would indicate this condition, for it would show a pulse pressure of 20 or a very week heart muscle.

These examples show that definite information as to both systolic and diastolic pressures is necessary from the standpoint of blood pressure, to give us a clue as to the condition of the heart muscle and the relative safety of operation.

Cases of recent hemiplegia or apoplexy also require careful investigation and management. In such, the epinephrin content should be held down to the proportion of 1: 100,000, or it should be omitted entirely. If this is combined with careful management of the patient, there need be no rise in blood pressure at all.

In cases of suspected exophthalmic goiter, the blood pressure should be investigated in the manner just stated and a metabolism test made to determine how much this patient suffers from the disease. In this entire group of cases, local anesthesia is far safer than is general anesthesia. So is it in angina pectoris. The danger incurred by such a patient is greater than that incurred by an individual not so afflicted. An accident may happen, due to nervous excitement, the expectation of trauma or pain or other psychic disturbance, but not due to the local anesthetic *per se.* Emotions are apt to bring on an attack which may end fatally; hence, relatives should always be informed of the added risk.

The extraction of infected teeth may cause death. Death has occurred after the extraction of one tooth in a case of acute endocarditis. The lesson to be derived from this is that such cases should be handled very cautiously. When the extraction of infected teeth is contemplated, those suffering from

cardiac or other metastatic diseases due to focal infection need special care.

Hemophilia is a constitutional anomaly which may cause a fatal ending even after a trivial operation. I am not referring to cases of troublesome hemorrhage after an operation; cases with normal coagulation time of the blood; but reference is made to cases of true hemophilia, and, in such, the history is of vast importance. This is an hereditary disorder in which the men are bleeders but do not transmit the affliction, and the women are not usually bleeders but transmit the tendency to excessive bleeding. These facts can usually be elicited from the patient. The individual knows his condition usually and, if he does, he is not reluctant to speak of it. Here prophylactic treatment is indicated. In any event, the risk of grave hemorrhage incurred by the operation should be placed where it belongs; that is, on the patient, and he or his relatives should be so informed before anything is done.

If the accident has happened, pressure, combined with astringents of various types, may be applied, such as packing the tooth socket with gauze saturated with an aqueous solution of tannic acid of syrupy consistency or with full strength epinephrin or with thromboplastin. Such packing should not be removed, but should be permitted to come out by itself. Thromboplastin made for hypodermic use may be injected in order to help along the local treatment, or horse serum may be used; but patients have died because with all these remedies hemorrhage could not be checked. Indeed, if, in severe cases, the socket is packed firmly enough to arrest hemorrhage, the gums in the vicinity are likely to bleed. Of course, a bleeding hemophiliac should be kept in bed with the backrest up. He should have liquid diet and the bowels should be kept open. Absolute quiet is essential so that the blood clots be not disturbed until they are solid enough to resist motion on the part of the individual.

Postoperative bronchitis or pneumonia may be included in this list of accidents. This is rather rare and, when it occurs, is embolic in character. In such a case, the dentist should call in an internist to manage the treatment.

Collapse followed by death may be met with as a coincidence in which the accident happens to take place at or immediately after the time when a local anesthetic is administered. I know of such a case in which death at necropsy was shown to have resulted from a combination of status lymphaticus and advanced nephritis; this, in a patient more than 40 years of age.

Then we meet with cases of procain or epinephrin idiosyncrasy. These are rare, but they occur frequently enough to emphasize the necessity of caution. The injection should always be made slowly and the patient's condition carefully watched. If there is a good deal of excitement, pallor, trembling, etc., injection should be delayed. A preceding searching inquiry into the antecedents, also the help of the family physician, may furnish important data.

Accidents may happen from the injection of an improper solution. I was able to prevent a serious, if not fatal, issue by carefully watching the patient while very slowly injecting the anesthetic agent in a case in which, through the error of a nurse, the epinephrin content in the solution was greatly in excess of what had been ordered.

This brings up the subject of toxi-

cology. I have stated in the beginning of this paper that a proper solution carefully injected and within safe limits as to amount rarely, if ever, causes untoward symptoms. If these conditions are not observed and the patient receives an overdose, or if he has an idiosyncrasy to the anesthetic, symptoms may develop. In a general way, these can easily be differentiated, because symptoms of overdosage of epinephrin appear almost at once, come on quickly, last but a short time and disappear quickly; while the symptoms in overdosage of procain are said to come on slowly, perhaps the next day or the second day thereafter. In procain overdosage, the symptoms are more persistent and clear up slowly. I have never seen a case of procain poisoning, but the symptomatology given is one in which the general symptoms of shock stand out prominently. There is said to be coldness and clamminess of the skin, with copious perspiration, dilation of the pupils, nausea and perhaps vomiting, pallor, dizziness, dyspnea, irregular respiration, tachycardia, palpitation, precordial depression, the presence of a rapid, feeble, thready pulse, trembling, syncope and coma, and sometimes death ensues.

I have witnessed many cases with symptoms of overdosage of epinephrin especially in the early days when we used 2 per cent procain with plenty of epinephrin, before we learned the ideal proportions and doses in which these drugs should be used. To repeat: In epinephrin overdosage, the symptoms come on quickly. The outstanding feature is pallor. The patient may complain of headache, but nervousness is one of the marked features. There may be dyspnea and a feeling of oppression, also precordial pain. Dizziness may be complained of. If enough of an overdose has been injected and especially if some or most of the injection has gone into a blood vessel, syncope, collapse and even a fatal ending may result.

The treatment in either procain or epinephrin poisoning is symptomatic. The patient should be put in a horizontal position or with the head lower than the body. Slapping the face with a towel wrung out of ice water is a good stimulant. So is the use of aromatic spirits of ammonia or strong black coffee or caffein. Also, heat should be applied to the body by hot water bottles or other means. In the more serious cases, validol may be given in doses of from 5 to 7 drops, or amyl nitrite, 1 to 3 drops by inhalation; whiskey, camphorated oil hypodermically, etc.

An accident which occurs frequently and which is spectacular, scaring both the patient and beginner, consists in the occurrence of a rapidly increasing swelling of the cheek either while or immediately after the pterygopalatine injection is made. This is due to puncturing one or more blood vessels in that fossa, which causes a hematoma. In such an accident, the patient should be assured that no harm is done and that the application of fomentations will result in complete recovery in a few days.

Finally, the most interesting accident with which we are confronted is that of the broken needle. This usually causes a great deal of anxiety on the part of both the patient and the operator, and frequently results in a suit for malpractice. The accident is of sufficient frequency to warrant a somewhat detailed discussion. Faulty technic causes a large majority of such cases. A needle that is too short or too fine may provoke such an accident. It easily

breaks after it has been inserted to the hub, and usually is buried in the tissues. A rusty needle which has cried for a long time for replacement by a new one may be another source of grief. Last, but not least, it may be the result of faulty technic on the part of the operator attempting the injection.

Since most needles are broken in an attempted conductive mandibular injection, I shall confine my dicussion to that technic, although the principles underlying the occurrence of these accidents are the same in all injections.

I am committed to the steel or nickel needle, and I am so committed because I wish to know where the point of the needle is while I am carrying it to place, also, when it arrives at its destination. I wish to be able to feel with it, and you cannot feel where the point of a soft needle is. A spectacular display of sterilization is made by passing a platinoiridium needle through the Bunsen flame, heating it to a red heat in sight of the patient before making the injection; but a more modest method secures just as good results. The problem of expense does not enter if we use steel or nickel needles, for they are so cheap that dull ones may and should be replaced by new needles, before they grow rusty. The needle should be at least one fourth inch longer than the greatest depth to which it is to penetrate the tissues so that, in case it snaps at the hub, and that is the usual site of breakage, one fourth inch of needle is in view. A goldfoil carrier or other suitable instrument serves to remove it quickly and easily. The most important point with reference to broken needles lies in the technic advocated by some operators. This contemplates anesthetizing the lingual nerve with the syringe parallel to the arch on the same side, then, with the needle in the tissues, swinging the syringe over the bicuspid region on the opposite side, after which the needle is to be advanced in the new direction into the mandibular sulcus. Such attempts at making needles go around the corner after they have entered the tissues are thought to be necessary because of the erroneous opinion that the lingual nerve cannot be anesthetized by an approach from the opposite side. My experience has been quite different. I have had failures, in my early days especially, when attempting to reach the inferior alveolar nerve, but never a failure to reach the lingual nerve. The technic I use requires the insertion of the needle to the lingual nerve with the syringe on the opposite side in the bicuspid region and its advancement in the same direction until the mandibular sulcus is reached. If operators will pay heed to this particular point in technic, the number of broken needles will diminish materially. The patient should always be cautioned to sit perfectly still, before inserting the needle; that otherwise *he* may break it, and if it breaks, it is at his risk, and an added expense to have it removed.

The removal of a broken needle may be very easy or it may be so difficult that such an attempt would be ill-advised. The location of the needle, its length, the facility or difficulty to approach, the length of time it has been in the tissues and the likelihood or lack of it of wandering are some of the factors which determine the treatment. Sometimes, one can feel the broken end with the exploring finger and, in such a case, it is usually not hard to cut down on it, connect with it and remove it.

In case it cannot be palpated, radio-

grams are indicated. Two exposures should be made, one lateral, the other frontal. The location of the needle may thus be accurately gaged and its removal thereby facilitated. In more difficult cases, the patient may be given a local anesthetic, as he should be in all attempts at removal, but the needle is left *in situ*. In the radiograms made, the second needle serves as a guide to the buried one.

A powerful magnet may at time facilitate the removal of a needle. It must be remembered that unless the magnet almost or quite touches the needle, the intervening tissue neutralizes the magnetic current, and failure is the result.

The use of the fluoroscope may bring about a successful issue in very difficult cases, but it has its drawbacks. The danger of roentgen-ray burns both to the patient and to the operator; the difficulty of changing from a light to a totally dark room; the difficulties of working without seeing the field one is accustomed to see, etc., all combine to lead me to place the use of this agent last. The fact remains that, if a needle is broken, its removal as early as possible after the accident is the best means to kill a threatening suit for malpractice. Removal of the needle is still more important if the operator failed to observe all the precautions set forth above or if the patient is of the type who is prone to look for damages.

Just two more points: In practicing local anesthesia, especially the conductive type, and wherever deep injections are made, care should be taken really to get the end of the needle where it is intended. In the infra-orbital injection, this means to get it into the infra-orbital foramen. A pterygopalatine injection is successful only in proportion to the operator's success in keeping the end of the needle near the posterior surface of the maxilla, and likewise, in the injection of the long buccal branch, the cheek should be entered below Stenson's duct, the operator advancing the needle horizontally backward and aiming for the anterior border of the mandibular ramus, thus keeping it out of Stenson's duct and the parotid gland. To inject into the latter may cause serious difficulties.

Finally, let me emphasize the importance of good case histories. This includes written records, not only of the symptoms, but also of the course of the cases and end-results. No history is complete until the end-results are recorded, such as "discharged," "cured," or "improved," or "unimproved," etc. To keep accessible such histories is our duty, both for professional advancement and for dentolegal purposes.

THE DENTAL LIBRARY—ITS PAST AND ITS PRESENT*

By BERNHARD WOLF WEINBERGER, D.D.S., New York City

AMONG those whose interests lie in research, whether of a purely academic or an historical nature, or pertaining to the more intricate phases of dental science, or those who wish merely to satisfy a certain "hobby" along scientific thought, one cannot but note with satisfaction the growing interest manifested in various directions in the creation and the maintenance of dental libraries by the dental profession itself.

Without a literature, a profession is handicapped and can make but little progress. Every science has its literature, and in order for dentistry to progress, it must continually advance from one position to another, keeping pace with the ever-changing record of the discoveries and educational methods that are constantly revolutionizing it.

Today, dental literature has become a specialty and should be so treated in all library work. It requires the attention of one who is acquainted with it, and when it receives this attention, it attains the greatest usefulness. Otherwise, it lies dormant, to accumulate the dust of neglect.

Only within comparatively recent times has a renewed interest been aroused within the profession. At the time the Society of Surgeon Dentists of the State of New York was organized, in 1834, a library was started, but, as with all libraries founded by societies, when the society went out of existence, the library was broken up, sold or given away.

Nearly all of the present large dental libraries had their origin with individuals, and later were turned over or sold to institutions as a nucleus for greater things.

Beginning with Chapin A. Harris, we find that his large private and dental libraries were sold at auction in New York City in 1865 to help relieve the straitened circumstances of his family. The wonderful private library of H. J. McKellops is now in the possession of the Dental Department of Washington University, St. Louis, amid dust, neglected, not properly cataloged or cared for. A. L. Northrop's library fared far better, as it is now housed in the New York Academy of Medicine, where it was placed in 1897. The libraries of B. T. Whitney and T. G. Lewis were given to the Eighth District Dental Society of New York. W. C. Barrett's went to the University of Buffalo, 1905. W. H. Morgan's library went to Vanderbilt University. E. C. Kirk's and Jesse Green's libraries were given to the University of Pennsylvania. The library of Alfred P. Lee was sold to the University of Pittsburgh. Jonathan Taft's was bought by Theodore Menges, and with many

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others, among the more recent, the William H. Trueman, is now a part of the Northwestern University. Amos Westcott's library was bought by E. A. Bogue and was in turn purchased by me. To these must be added at least two others, now privately owned by Andres Weber of Havana and Thomas Dow of Stanton, Mich. There are two others worthy of mention, the library of the Surgeon-General's Office, Washington, D. C., and that of the *Dental Cosmos*.

Some of the large libraries on the other side are those of John E. Greven of Amsterdam, A. Sternfeld, of Munich, and Carl Röse, of Dresden. More than 500 volumes of this library have been purchased by me, consisting mainly of the very old and historical books on dentistry. These, with the Bogue's and my own historical, bibliographic and orthodontic library, will be placed in the new New York Academy of Medicine when it is completed.

There are also the La Bibliotheque Nationale, Paris; Société de L'Ecole et du Dispensaire Dentaires de Paris; Nederlandsche Bibliotheken, Gravenhage, and many others.

Two large and valuable libraries (of the Tokyo Dental College and the Nippon Dental College) were unfortunately completely destroyed in the great earthquake. They contained many rare volumes.

On the whole, while the general interest among dentists in the literature of their profession has been limited, and the average dentist apparently confines his professional reading to a few current periodicals, there is a growing interest in this particular field of dental science. The movement manifested is encouraging because it gives practical evidence of a new stage of development in our professional life; and while those few great pioneers in dentistry gathered together as much of the literature as possible, with a few known exceptions most of these libraries have ultimately found their way into our dental schools and various larger libraries and were used as a nucleus to achieve and inspire to greater things.

The first step toward the correction of the difficulties and a radical improvement in our literature was the classified subject index for dentistry made on the plan of the Dewey Decimal Classification, as revised by Arthur D. Black and used throughout the new "Index of the Periodical Dental Literature;" also "Manuel pour la Classification décimal, etc.," by Emil Huet, Bruxelles, 1920. The next was the "Index of the Periodical Dental Literature" itself, as well as G. Port's "Index der deutschen zahnärtzlichen Literature und zahnärtzlichen Biblographie."

The final step toward further improvement should be the establishing of well-regulated dental libraries, repositories of our literature easily accessible to our profession. This is preeminently necessary. Then, there should be a new index of dental literature (books), with a key arrangement showing in which libraries they could be found. Both of these projects should be supported by an organization especially founded to aid this movement.

The creation of a dental library is not the work of a day, but of years, and it can be accomplished only when actively supported by the unremitting interest and enthusiasm of those concerned, and that means the whole dental profession. The material is not lacking though

the earlier books and journals are now difficult to obtain, but what is more needed is that whenever and wherever a movement toward creation of a dental library is initiated, that fact should appeal to all dentists accessible to such a center, and they should regard it as their duty to further this work. As an aid in the establishing of new dental libraries and the building and strengthening of the older ones, I will refer those interested to an article published in October, 1923.[1]

Today, we have, so far, established five types of dental libraries arranged in accordance with my idea of their value to the profession:

1. Dental libraries an integral part of a large medical library, such as the Surgeon-General's Library in Washington; the one I am connected with; the New York Academy of Medicine, and the Denver Dental Association's Library.

2. Libraries in universities or colleges, such as the Northwestern University Dental School, Chicago; the University of Pennsylvania, Philadelphia; the University of Michigan, Ann Arbor, and many others.

3. Libraries belonging to and owned by dental societies, such as the Eighth District Dental Society, Buffalo, N. Y.

4. Libraries connected with public libraries, such as the Cleveland Public Library.

5. Private libraries.

As dentistry today is considered a part of medicine, I desire to call your attention to the advisability of having the dental library a part of the medical library. This, I know, will not find favor with a majority of dental librarians, and only because they are not conversant with the conditions.

The situation in this country as regards the dental library has been considered in a special article of mine that appeared in "Polk's Dental Register and Directory" (1925), and will not be discussed in this paper.

The question of establishing, and the methods of handling the material in a dental library have been treated in another article[1] already referred to, so will not again be considered.

My problem today is the future of dental libraries and the means whereby they may be improved.

I have already stated that we have today five types of dental libraries. These can readily be divided into two groups: (1) those connected with already large medical or established dental libraries, and (2) the college dental group. The two groups must be treated differently as their needs are vastly different.

The first duty of the library is, naturally, to give all possible aid to the members of the profession in their general inquiries and their desire to borrow books, and reprints, and, where these are lacking, periodicals. To be of the greatest service, it has been found necessary to keep every scrap of information concerning dental activities. One of the most important of our responsibilities as an educational institution can be met only by our opening the library to the public, as distinguished from the profession. Another important phase of the future service that libraries should render the profession consists of bibliographic work, the making of lists of dental articles on a particular subject

1. Weinberger, B. W.: Preservation of Dental Literature in Libraries, J.A.D.A., 7: 952 (Oct.) 1923.

and seeing that the volumes containing these articles are available to the writer. After the latter has read over those articles in the languages which are understandable to him he should be able to have translations made and parts copied for him. It is not the purpose of the library to write dental articles, but merely to aid in their production.

Another important educational possibility is the arranging of exhibitions of dental works, medals, engravings, instruments, etc., illustrating an important dental anniversary, the developing of our knowledge of certain specialities, its history, etc. To appreciate thoroughly the work of those contributors who have gone before us, we must know the lives as well as the writings of those who wrought. The value of such exhibition, carefully planned, cannot be easily gaged.

As a library serves two functions, the education of students in the history and methods of the science of dentistry, and the promotion of research in these subjects, an attempt should be made to build up, first, the large established libraries in certain geographic centers, such as Boston, New York, Philadelphia, Baltimore, Nashville, New Orleans, Pittsburgh, Ann Arbor, Michigan, Cleveland, Chicago, St. Louis, Denver, Portland, San Francisco and Los Angeles. Through some system, the smaller libraries can then fall back upon these for their future needs, as well as the occasionally called for book or periodical.

These libraries should endeavor to secure:

1. All modern dental books in various languages.

2. Completed files of all dental periodicals, the library having the most complete file to be given first choice, this insuring some complete files of each periodical. Libraries outside these centers should be asked to contribute their material when files are not complete.

3. Old dental books, monographs, etc., preference being given as above.

4. Pamphlets, reprints, theses and inaugural dissertations.

5. Material relating to dental history, such as printed matter, manuscript, diaries, notes, scrapbooks, clippings, pictures and relics.

6. Nondental publication of dentists, such as biographies, novels, etc.

7. Professional school catalogs, announcements and other school publications, and hospital health reports.

8. Transactions of general scientific societies.

The problem of the library in the dental schools is vastly different from that of the larger "center" or professional ones and the material and use thereof is thereby altered. Here, a purely working library should be undertaken and brought up-to-date and kept so. With such a library established, the course should be so arranged as to acquaint the student with the resources of the library and show him how to avail himself of this material by inducing him to use the library. This necessitates instruction as to how to utilize (1) the card catalogs, indexes, etc., and (2) the literature.

What a paradox it is when colleges give instruction as to how to sharpen instruments and the use of them, and neglect to teach the student how to use a library to the best advantage, expecting them to prepare papers on some one topic by simply placing them in a room surrounded by furniture and books.

The status of a dental school library will depend on the location of

the school. If it is in a community already provided with a good dental library, the endeavor should be to have a first class reference collection, consisting of the latest and best books, periodicals and special references works on the biologic sciences and the material necessary for the special research laboratories.

The selection of material would have to be worked out separately for each school, as most institutions have activities peculiar to themselves. The textbooks should be kept up to date, and when new editions are added, the old ones should be discarded and placed in the reserve section.

If the school has not access to a good dental library, its own collection should be as comprehensive as possible. Students should be taught to realize the value of a dental library and should be encouraged to read the periodical literature, and some bibliographic teaching should be included in the curriculum. I should like to see a resolution presented to the Faculty Association that steps be taken to see that this be done. If a dentist is trained in his student days to make proper and intelligent use of a library, much valuable time will later on be saved to both the individual and the library.

I wish here to urge the organization of a dental library and museum association international in character. This can be done only through cooperation. Under its auspices, a new bibliography of the dental literature should be prepared and brought up to date. When this is completed before final publication, enough galley proofs should be furnished to supply all the libraries and each should be requested to check and correct the list. At the same time, each library should be given a code number to be placed before each title found in this library. When the bibliography is published, this number would appear before each item, and thus those interested would know immediately where to find the volume wanted.

This organization should have its bulletin and should issue monthly a list of important recent accessions to the library, changes in journals, etc. The standardization of a list of abbreviations used in bibliographic work would make for uniformity.

In the interests of uniformity, I desire to recommend that:

1. The appended schedule be used by all members of this Association for reporting their statistics, and each library forward to the Secretary of this Association each year a copy of its annual report containing its statistics compiled according to this schedule.

2. In making the account of the volumes and the pamphlets in a library, either the accession book or a memo system be used but should be corrected for lost or withdrawn books and by the inventory. Uncataloged or unaccessioned material or estimated lots must not be included.

3. The American Library Association rule of volume and pamphlet be adopted; everything of 100 pages or over to be called a volume; everything of any size, if bound, a volume; everything under 100 pages and unbound, a pamphlet. Reports and complete unbound periodicals, if cataloged or accessioned, should be classed according to the rule. Incomplete unbound periodicals must not be included.

4. Second copies for general use be merged in the general count of the library. Reserve collections must be

accounted for separately. Duplicates must not be counted.

5. As far as possible, figures of circulation and attendance of readers be recorded.

6. Serial pamphlets and theses with a consecutive numbering be bound and counted as volumes, unnumbered serials being counted separately.

7. Reprints and pamphlets, if bound, be confined to limited subjects, and the bound volumes counted as such.

GENERAL SCHEDULE OF STATISTICS FOR DENTAL LIBRARIES

Annual report for the year ended.
Name of library.
City or town. State.
Number of dentists in community.
Population of community.
Terms of use—Free for reference. Free to limited class. Lending to limited class. Subscription.
Number of days open during the year.
Number of evenings open during the year.
Hours open each week.
Total number of staff.
Total valuation of library property.

INCREASE

Number of periodical volumes at beginning of year.
Number of other volumes at beginning of year.
Number of periodical volumes added during the year.
Number of periodical volumes lost or withdrawn during the year.
Number of other volumes added during the year.
Number of other volumes lost or withdrawn during the year.
Total number of volumes at end of year.
Number of pamphlets at beginning of the year.
Number of pamphlets added during the year.
Number of pamphlets lost or withdrawn during the year.
Total number of pamphlets at end of the year.
Total number of current serials and periodicals. (Titles.)

USE

Total number of volumes lent for home use.
Number of restricted loans (overnight, twenty-four hours).
Number of interlibrary loans.
Recorded use in reading rooms.
Total attendance of readers.
Evening attendance of readers.

Receipts from	Payments for
Fees of members.	Books.
Trust funds.	Periodicals.
Gifts.	Binding.
Other resources.	Completion of files.
	Salaries.
	Other maintenance.

40 East Forty-First St.

DISCUSSION

Edward C. Mills, Columbus, Ohio: When I accepted the invitation to discuss this paper, I had no conception of the vast amount of work that has been done and is still in progress by Dr. Weinberger in the literature of dentistry. His work, as that of Dr. Weber, of Havana, to my mind seems colossal. It has entailed an unselfish sacrifice of time and money, and such untiring efforts deserve the deep gratitude of our profession. For some reason unknown to myself, the library of which I am secretary, and have the honor to represent, is not enumerated in the list of libraries mentioned by Dr. Weinberger. I therefore offer an apology for accepting the invitation to discuss this paper, but do, however, claim a slight distinction from the dental laymen as regards dental libraries, as my activities in this field cover a period of twenty years. All these years of experience in the library field, after seeing the work of Dr. Weinberger, and that of Dr. Weber, make me feel but a novice. I represent the dental section of the Columbus Public Library, which is the library of the Ohio State Dental Society, and was organized in 1906. It is governed by the rules and is under the supervision of the public library. This insures permanency of location and perpetual care. It is, I believe, the first dental library, the property of a municipality, and housed in a municipal building. From a nucleus of 400 volumes, purchased by the dentists of Columbus, of the late A. H. Fuller of St. Louis, it has grown to one of 2,078 bound volumes (Dec. 31, 1925). To show the extent to which it is functioning, I

present reference statistics for the past few years: 1920, 427 volumes; 1921, 547 volumes; 1922, 555 volumes; 1923, 472 volumes; 1924, 379 volumes; 1925, 686 volumes. I mention the facts of housing and placing the library under municipal control because, in the judgment of the founders, this plan will prevent its meeting the fate of libraries owned privately or by dental organizations as mentioned by Dr. Weinberger. This paper, which is replete with commendable suggestions relative to the creation and administering of a library, should be received with much enthusiasm by an audience interested in this particular subject, but to the layman dentist, it will have little significance, because a large percentage of our profession have no knowledge of the vast amount of literature that has been contributed to dental science. As stated by Dr. Weinberger, the vast majority of dentists are content merely to look over their current journals, and have little interest in the past literature, history and traditions of the profession. Some years ago, when the dental course of instruction included a year with a preceptor, and two or three years in a dental college, there was no time to devote to studies not directly concerned in equipping a student for practice. With our present course of one or two years predental and four years of college work, it is a lamentable fact that but few colleges find time for a lecture on the multiple subject "Dental History, Ethics, Economics and Jurisprudence," one hour each week during the senior year. A limited course such as this cannot incite sufficient interest in the literature of our profession and its history. The Dewey Decimal classification and index applied to dental literature as arranged by A. D. Black and his coworkers and published at great expense by various dental organizations should be taught in the dental colleges because familiarity with this system and some knowledge of the vast numbers of references on subjects pertaining to dentistry could not fail to expand their mental horizon in regard to the literature of their chosen profession. To illustrate the general indifference and lack of interest in library work, I wish to state that I have served as secretary of the dental section for the past twenty years, and I have failed thus far to get any of our local dentists sufficiently interested to assume the duties of my office, which at this time are few because, I am happy to state, the files of our journals are almost complete. I cannot concur in the idea of having the dental library a section of the medical. Dentistry is not a specialty of medicine. It is a separate and distinct profession, and as such should never lose its identity, which has so long been established. A few years ago, an attempt was made by Dr. Weinberger to organize an American dental library association. The attempt was successful to the extent of two or three annual meetings, but did not create enough enthusiasm among the comparatively few interested in library work to insure more than an ephemeral existence. Another such attempt in the very near future, whether of national or international character, does not, to my mind, seem feasible. The establishment of this new section, known as "History, Science and Libraries" is very encouraging to those who, during the past, have been interested in this particular field of dental science. I believe that, through this section, there will be an unfolding of the advantages and the greater possibility for professional advancement through libraries established along the lines suggested by Dr. Weinberger. I further believe that we are nearing the dawn of a new era, when the profession generally will take a keener interest in its realm of literature.

A. G. Weber, Havana, Cuba: I am in favor of Dr. Weinberger's ideas and also in favor of the establishment of odontologic sections in large medical libraries which have a guaranteed support. History has taught us that the ultimate fate of all small or large libraries that have no permanent housing is their disappearance or dissolution. The late Dr. Northrup of New York, in spite of the solicitation of the then small dental societies of his city, left his very good library to the Academy of Medicine of New York, and it is therefore still in existence and in its former completeness. Almost all other libraries that have belonged to dental societies have disappeared. In Havana, we had, in 1895, a very good library which belonged to the Sociedad Odontologica de la Habana, which was housed in the librarian's residence. At his death, it disappeared and no one knows what became of it. An odontologic library in a general medical library will be available for consultation by the medical profession and at the same time the general medical books will help us when we need general or special works on medicine.

INVESTMENT MATERIALS*

By WILLIAM H. TAGGART, D.D.S., Chicago, Illinois

THERE has been a good deal of controversy the last few years about investment materials, and my talk to you tonight will consist rather in explaining the basic principles of investment materials and the method of handling them than in trying to convert you to using any one kind of investment. One of the principal ingredients in an investment material is plaster of Paris, which comes from mines, being chipped and blasted out just as ore is, in the form of medium hard rock, called gypsum or calcium sulphate. This ore is crushed to any degree of fineness desired, and is put in large cauldrons, where, by constant stirring and rotating of these cauldrons, it is brought up to a high degree of heat in order to drive off the water of crystallization. The gypsum is ground to all grades of fineness needed, and these different grades are segregated by sifting. Even in the coarser grades of plaster, there is a large percentage of fine and superfine particles of plaster. Therefore, the degree of fineness of plaster in an investment is not so much of an element in allowing the air to escape from a mold as some have tried to imply, as the high percentage of fine or, as it is called in the cement trade, "neat" material is sufficient to fill the interstices between the coarser grains, this tending to make a material just as impervious to air as though it were all made of fine material. The reason the coarser grades of plaster are not more in use in investment materials is that they do not lend themselves to manipulation so readily as the finer grades do. If we mix a batch of coarse plaster thin enough to pour on a glass surface and another batch of fine plaster and pour on a surface, we find that one surface has about the same degree of smoothness and imperviousness to air as the other; in other words, the "neat" material has a tendency to settle to the surface which it touches. When this plaster is first burned and cooled, it sets very rapidly; in fact, too rapidly for any dental use. This tendency is controlled in the factories by taking certain known quantities of plaster that has already been set and grinding it without further burning. This, in a crude way, controls the time in which the plaster sets. When this new plaster has water mixed with it, the water of crystallization which the original gypsum rock had is restored, and it is brought back to a crystalline form, but is never so hard as the original gypsum rock was. The other principal ingredient in an investment material is silex. The principle here is the same as regards the different grades of fineness as in plaster. There are all grades of fineness when this is crushed. I may explain this a little

*Read before the Chicago Dental Society, Oct. 19, 1926.

more plainly by saying that recently I had some material which I bought for 90 mesh, which only means that the largest particles are 90 mesh, the rest going through all different grades down to impalpable powder. I found that out of this 90 mesh material, 50 per cent would go through a 200 mesh sieve; and one-half of the 50 per cent, or one-fourth of the original amount, would go through a 600 mesh, and there were all grades of fineness up to possibly the thousandths. These are the two principal ingredients in any investment material. Now these materials, after being manufactured, are quite hydroscopic; that is, they have a tendency to absorb moisture, and in just the proportion as the material is allowed to absorb moisture, it will change its setting qualities, or it will change the length of time which it takes to set. Sometimes plaster and silex, being crude materials, are allowed to stand on the railway platform in the drenching rain, and the barrels become water soaked, the plaster eventually absorbing more or less of this moisture, which accounts, in a great measure, for the fact that two shipments of plaster from the same original batch seldom work exactly alike, as you have all noticed, and as all dealers have noticed when the dentist comes back claiming that the plaster does not set the same as the last that he bought. Any other ingredients mixed with these two materials are usually trade secrets. In speaking of these different investment materials, and the principle of their use, it is hard for me, as a manufacturer of investment material, to keep from using the personal pronoun, as though I were trying to persuade you to use my material. Such is not the intention, and when I allude to my material or any other material, I shall mention the names without an idea of criticizing the material of others or advertising my own. I hope you will understand this thoroughly. Weinstein, in one of his exhaustive and not very scientific articles published in one of the dental journals, made the remark that he and his associates had found that graphite is not of any use in an investment material.

He did not mention my name, but mine is the only investment that has graphite in it. In talking to a professional audience on a professional subject and as one of the profession, certain ethics are required, but as all of these men are now, regardless of their titles, manufacturers, I may as well speak openly as to the qualities of the different materials. As Weinstein has made the remark that he has found graphite of no use in an investment material, I shall explain to you why I have put it in mine. When I was a boy, from the time I was 8 until I was 18 years of age, I was always "hanging around" factories and machine shops. Living in a comparatively small town, being acquainted with practically all of the factory men and machinists, and not making myself a nuisance, I was allowed to help with little things about the work, and one of my self-imposed duties was to take a chunk of charcoal, place it in a loose cotton bag, and with a board or hammer, crush it into a fine powder. Some of it would be exceedingly fine. As I have told you before, any crushed material will have all grades of fineness. When the mold was open and the pattern taken out, this bag of crushed charcoal would be shaken and the mold would be sprinkled all over with it, so as to make a smooth casting, as it seemed to fill up the meshes in the grains of sand and also made a good surface against which the hot metal would run. This was on

coarse castings. You possibly have noticed that, on stove work, the lids and all parts of stove castings are very smooth and fined grained. In the case of these stove castings, instead of using charcoal, which was only used for the coarser grade of work, they substituted fine graphite, sprinkling it on the surfaces of the mold. On surfaces they could reach with their trowels, the workers would work this fine graphite into the sand surface. This is why the stove castings are the smoothest of all castings that we see. When the time came for me to develop my investing material to carry out my ideas in casting gold, the only materials we had at hand were not manufactured products but self-made materials, consisting in some cases of fine sand and plaster; in others, of marble dust and plaster, and in others, of pumice stone and plaster. These materials were all right for the purpose for which they were intended, except that they were made by rule of thumb. The manufacturer would take some plaster and some sand, or some pumice stone or some marble dust, never caring much about the proportion, and would use it for the solder work. Of course, no gold was supposed to be molded against this kind of surface, so that it answered all practical purposes. When it came to developing an investment for casting, a different surface had to be found. This was done by using a high grade of plaster, and fine, very fine, silex. Even this did not give the proper surface, because plaster came in direct contact with the wax. I tried to line my molds with graphite, taking my cue from my early experience in working about factories. I did this by trying to spray it with a syringe into the inside of the mold; but this did not answer, for the reason that the delicate corners would be filled up with too much graphite and it would be practically impossible to get it out again. When I conceived the idea of mixing a certain proportion of graphite with the plaster and silex, I found that I could get much more satisfactory castings, because this exceedingly fine graphite in small quantities has a tendency to flow to the surface and cover the surface before the other materials set. This, you can see, will give a uniform surface of graphite to the inside of the mold where it comes in contact with the polished wax. The graphite, being unburnable at very high temperatures, does not disintegrate under high heat as does the plaster content; and the plaster proper, being protected by a thin layer of graphite, was in a better condition to receive the high temperature gold without burning the plaster. Now my investment has another grade of graphite put into it, a very coarse grade, which answers the following purpose: These particles of coarse graphite are exceedingly thin, so very thin, in fact, that it is almost impossible to measure them. The size and circumference is about one sixteenth inch on the surface, and these coarse grains of graphite overlap each other, acting like shingles distributed uniformly through the plaster base. While this graphite has no tendency to make the plaster harder, it does make it tougher, because this shingling effect, running through the whole mass, binds it together and makes the material much tougher, but no harder. Hardness is not the only quality an investment needs. Toughness is of more importance Other ingredients are put into this compound for certain specific purposes, and have no particular bearing on the scientific side. After this investment was developed, I found that, taking into

consideration all of the minute and acute angles that a wax pattern might have, it was almost impossible to get a thick mix to go into these sharp angles, so I finally made a compound which could be mixed to the consistency of very thick cream and would pour and, of its own accord, run into these fine angles, which always should be painted first with some of this fine graphite mixture that comes to the surface in the mixing bowl. This puts a very stable coating of graphite, plaster and silex on the surface next to the pattern, which makes an ideal surface to cast against. After getting these ingredients properly proportioned, I found that there would be no two batches of the consistency obtained by the old methods. So, in order to make this process as scientific as possible, I substituted the weighing device, by means of which the proportion of investment and water were the same each time, instead of weighing by rule of thumb, by putting in a little water and a little more plaster, etc., since the length of time required to get through this process in mixing would finally reach a stage at which the setting qualities of the plaster would mislead the dentist as to the quantity of water. By weighing the ingredients, I got more and more uniform results. We will take up, first, some of the points that I would call intensive salesmanship in praising the virtues of certain so-called processes. Take, for instance, an investment that has come out within the last year or so and is designated as "Knapp's process," which consists in putting a coating of finer material around the wax pattern and letting that set to a certain extent and then surrounding this with a coarser investment. Why it should be called Knapp's process is a mystery to me. I will give Dr. Knapp credit for, possibly, not knowing about what I am going to tell you now, and not having any ulterior motive in calling it Knapp's process. If you will look in Dr. Goslee's book on crown and bridge work, you will see this identical process described in the 1907 and 1910 editions. You will see the different steps that I took in the early stages of my work. You will notice the primary coating put around the wax pattern and the secondary coating surrounding it in the flask. This is part of the so-called Knapp technic. Along with this, Dr. Knapp advocates boiling out the wax by forming steam, which is formed in the excess water that is in the mixture. When this gets to a point where it is sufficiently hot to melt the wax pattern on the inside of the mold, by turning the flask upside down, the wax is supposed to run out with the steam. A good portion of it does run out, but when the wax pattern is brought up to the temperature of this steam, which is at least 212 degrees (temperature at which water boils), that wax is thin enough also to soak into the investment compound. After this, it is dried out to get rid of the last vestige of water that is in the investment, which is not sufficient to form a visible steam. Now it seems that the inside of the mold is perfectly free from wax, but it is not. The detrimental wax is still inside of the mold, and an excess of heat will be required to volatilize it. This, Dr. Knapp does not explain; but when he has the moisture driven off by this low heat, he commences to melt his gold, and by the time his gold is melted, he has put enough more heat on this investment to burn out the wax and to that extent has driven off the water of crystallization in the plaster, just as though he had volatilized that wax in the first place.

Of course, this sounds like a quicker process, but it is not. A few years ago, at one of our dental clinics, a young man was down on the program to show his process for making gold inlays, in which he said there was no necessity for burning out the wax; but he unconsciously did that very thing by the length of time he had to keep his blowpipe on the gold, and before it could be melted, he had burned out the wax just as had to be done in the use of all other investments. Now, as to the advantage of using coarse material for the outside coating which is placed over this primary investment, so that it will be more porous for the air to get out of the mold! If this wax has been volatilized before the gold has been thrown into the mold, the amount of air that has to be displaced to let this gold into the mold is so infinitesimally small that no matter how fine the investment material may be, it is still porous enough to let the air out. For instance, when you commence the melting of the gold, the mold is full of air which is of room temperature. As soon as the heat comes on, this small quantity of air in the mold cavity proper is rarefied, and, in this condition, there is not, possibly, one-tenth as much as the original amount of air to be got rid of, and under the pressure of casting, the air will get out. This gets rid of what is called air bubbles. The gas bubbles that form from the residue of wax are the ones we have to contend with. These gas bubbles result because the wax has not been thoroughly volatilized, and when the hot gold strikes the remaining wax, it immediately forms into gas pockets. Therefore, leaving the least bit of wax in the mold by failure to burn it out thoroughly is what does the harm; not the fact that the air cannot get out of the mold. By the time the heat has reached the point necessary to volatilize this wax, the plaster of Paris, which is called the binder, has been disintegrated, and is practically the poorest material that is in the investment material; and this holds good for any investment that is made with a plaster of Paris binder. Now the proportions of plaster and silex also have a great bearing on the nonshrinking qualities of a good investment. Dr. Knapp, in one of his printed articles, has said that his outer investment consists of a coarse grade of silex mixed with fifty per cent plaster. A 50-50 proportion of plaster and silex, which is the nonshrinkable portion of an investment, will invariably mean shrinkage under the heat necessary to melt the gold. The plaster should be as small a proportion of the investment as can possibly be used and still act as a binder to help hold the particles of silex in place. These basic principles which I have given you hold good with any investment having a plaster of Paris content. Coming back to the mixing of these different ingredients, my theory, as possibly you know, is to mix the investment thin enough that it will pour, because chemicals have a peculiar habit, which is inherent in all of them, when the chemical affinities are satisfied; that is, when the powder has all the water it needs to make it set, the excess water is not utilized in hardening. Whenever a liquid and a powder such as we are speaking of are brought into contact with each other, a chemical and mechanical reaction takes place, and a chemical reaction always evolves a gas. Now, in mixing the plaster of Paris in a thick way, these minute quantities of chemical gases and the air that is contained in the water and the air that is contained in the powder are all mixed to-

gether, and these small bubbles of gas have not sufficient bouyancy to rise out of the mixture, but when the mixture is made thin and jarred and jolted, you will find, by closely watching the surface of your mixture with the magnifying glass, that the minute bubbles rise to the surface. The jolting of the investment bowl helps to make them rise and also, when they come to the surface, it explodes them just as, in our childhood days, when someone stamped on the floor, the jar would burst our soap bubbles. Now these gas bubbles are all in there in a thick mixture and cannot get out; and, in a thin mixture, we must take the time necessary to get them to the surface, where they will explode, so that there will be no gas bubbles whatever in the investment before the flask is filled. While these gas bubbles are rising through the investment material, they are very clannish, and, as soon as one touches the other, they coalesce, and, by the time they reach the surface of the wax pattern, they have formed into quite a sizable gas bubble, which accounts for the nodules of gold to be seen on the surface of the majority of gold inlays. The difference in time required to get an investment material into the proper working condition is time well spent, if our time is worth $5, $10 or $20 an hour, because, if we have these gold nodules on the inlay, it will take a quarter of an hour or more to get rid of the nodules on the surface of the casting; whereas, by mixing our material properly, and avoiding jarring our investment after it is in the flask, these gold nodules will not form. These gold nodules also have a disagreeable way of forming in some vital angle in the filling, and, under these circumstances, we have no guide as to how much to bur off in order to get rid of them and allow the inlay to seat itself properly as the wax did. The lack of fit of an inlay at the gingival margin, which occurs in so many fillings, is due not to the fact that the gold has shrunk or that the wax has contracted as much as that the cavity has been poorly prepared and the wax has never reached the gingival margin. When it comes to the melting of the gold that is to be forced into the cavity mold, after the wax has been burned out, the flask should be allowed to come back to room temperature, and then the gold should be melted as rapidly as possible. To do this, I would advise you to get some kind of a high heat blowpipe and not use a compressed air or blast blowpipe because this again brings the flask up to a high temperature and a high temperature means expansion. But use these high temperature flames in such a way that the flame will be a soft rather than the fast and furious one of city gas, acetylene or oxygen. These unreasonably high temperatures burn out the alloys in alloyed gold which cost from 25 to 50 cents per pennyweight more than pure gold. High temperatures burn out these alloys, and when the casting is finished, we have not the alloy for which we paid such a high price. In other words, dentists are spending hundreds of thousands of dollars for alloys that never get into the filling because they are volatilized into the air. I think the theory that the wax contracts or, as some say, expands is largely exploded. I will admit that wax in a molten state, when poured into a mold, shrinks materially, but that does not signify that, when it comes back to the body temperature, it will shrink, as the harder ingredients in a wax act as a binder,

holding the wax and keeping it from changing its form. Wax should be used at as low a temperature as we can possibly use it and still get it into its place under firm and steady pressure, not letting up on this pressure at any stage, putting the finger or thumb on a second or third time, as some do, in other words trying to knead it into place, because each time the pressure is taken off and then renewed, the wax is pushed into a new position, and when we finally get through with the pressure and have trimmed and burnished the wax to the margins as it should be, we have only a marginal fit, as the inside of the pattern has been shifted from one side to the other and can never make a true frictional fit; and yet the marginal fit may look all right. We should be a little bit shy of men who have two or three columns of statistics showing experiments under different temperatures. These statistics are meaningless, for the reason that the temperatures given are beyond anything required in practice, and they have no bearing whatever on the subject. In the early days of casting, when I advocated burning out the wax at as low a temperature as possible, which, at that time, I felt was not over from 250 to 280 degrees, Weston A. Price came out with a long and, apparently, exhaustive article, containing many statistics, and he based his conclusion as to my investment material on how it behaved at a temperature of 1,000 degrees. A few years after Dr. Price had written his article on investments, he came out trying to prove in a scientific way that wax would shrink in making patterns. Taking the statistics as they looked on paper and not as real facts, it looked as though he were making a point, and it did impress a great many dentists, and numberless articles have been written on the subject of "Contraction in Wax." Two years after these articles had been printed, Dr. Price came to my office and told me that, after further investigation, he had found that the shrinkage of wax in inlay work was not well founded and was of no importance. I want to make the point that these false scientific articles are very detrimental to progress in art, especially when they come from prominent men, for the reason that the dentist, finding that his inlays do not fit, falls back on what he thinks is the broad theory that wax changes its form so much, and thus accounts for his poorly fitting inlays and, in this way, excuses himself, or at least salves his conscience into the belief that his fillings are as good as can be made anyhow by this process. Whereas, if he were encouraged by constructive science, there would be a better personal equation in his work. If one man can do this work perfectly with any of these investments on the market, any other man can do the same if he will do it the same way and take the same care in his technic. I have admired Dr. Price for being man enough to come out and tell me that he had made a mistake. These pseudoscientific papers are ridiculous. A material should be tested under the conditions in which it is to be used and not in any outlandish way, with expectation that it will stand up under conditions which never exist in the real use of the materials. What I am trying to emphasize as thoroughly as I can is that one must first learn one's business thoroughly. When these materials are used, they must be used absolutely according to the directions that accompany them and under no conditions must these be varied. Once having learned this, one should strike out boldly

for self-expression; that is, try to improve on method and material, because the more we know of many things, the better we are able to appreciate every separate thing. To know only a few things, even though we know these well, keeps one in a very small circle.

Other thoughts which I could incorporate in a paper may be brought out to better advantage in an open discussion, and there has been enough material given here to bring out an exhaustive discussion. My admonition to you is not to wander away from the subject matter. Discussions are quite apt to lead the discussers into other fields which have nothing to do with the papers that have been read. I remember at one of our early meetings in the Illinois State Dental Society, a paper was read on the subject of operative dentistry. It was a good and instructive paper, but before the discussion was over, it wound up with a debate on the best kind of an articulator to be used in making full dentures.

ESTABLISHING THE PROSTHETIC CURVES OF OCCLUSION ON THE BITE BLOCKS IN FULL DENTURE CONSTRUCTION*

By ALEXANDER HORN PATERSON, D.D.S., F.A.C.D., Baltimore, Maryland

TO study any subject scientifically, it is necessary to analyze all of the parts that constitute the whole, and, from the analysis, determine the basis upon which the subject is built. Having determined the basis, each part in the reconstruction will assume a definite place and the rearrangement of the parts will be the method by which an intimate knowledge of the construction is obtained.

In dentistry, as well as in other allied professions, the foregoing statement would apply only to a small group, classified as investigators, whose minds would demand, in the study of any mechanism or subject, a detailed knowledge. The great mass of individuals do not possess minds curious enough to stimulate the desire necessary to investigate but are satisfied to accept the fundamentals established by the scientist in his investigation. This is as it should be; all cannot be investigators because the talent or mental vision necessary to make out a successful investigator is given to few; nor is it necessary that the dentist be an investigator, provided the mechanism or subject presented for his consideration by the investigator is easily comprehended and simple to apply. The dentist, ordinarily, is not concerned in the theory relative to the construction of any of the appliances used, but is vitally interested in the results obtained.

In developing the fundamentals necessary for a complete understanding of the method by which the curves of occlusion are established and presented

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in this paper, the greatest consideration is given in selecting only those points which will be of the greatest value in simplifying their accomplishment.

OCCLUSAL CURVES

The curve of Spee, the normal anatomic curve of occlusion of the human dentures, is usually illustrated by a line that begins at the incisal edges of the lower anterior teeth, passes over the cusps of the bicuspids and molars and ends in the coronoid process of the temporal bone. In addition to this anterior-posterior curve, there is a lateral curve, which may be seen plainly by sighting over the occlusal surfaces of the teeth in a natural lower denture.

In a mouth presenting a perfectly normal arrangement, the teeth would be alined nearest to the vertical and the curves would be in the best position to resist the stress of mastication. In a mouth presenting an abnormal arrangement of teeth, that is, an anterior protrusion, a lesser resistance to stress would be obtained owing to the fact that the teeth would take a more angular direction as the protrusion of the jaws became more pronounced. The abnormalities in a natural denture would not ordinarily hinder mastication to any great degree, except in extreme cases, because the teeth are fixed in position in the bony sockets of the maxilla and mandible of the jaws; but, in the artificial denture, the appliances are movable and it requires a reestablishment of the curvatures to maintain them in position.

The prosthetic curve is designed to stabilize the artificial dentures by nullifying the anterior component, the anterior component being the force exerted in any direction other than that of the main direction. Many examples of the force exerted anteriorly are apparent in natural dentures. The loss of a single tooth will exhibit the tendency of the tooth posterior to the one extracted to drift forward; or the loss of all of the teeth will exhibit the tendency of the mandible to move forward if no provision has been made to maintain it in position. Various other illustrations may be offered between these two extremes to prove still further the forward movement. Conclusive proof is the demonstration of this fact observed in the mouths of the patients served in daily practice.

No effort is made to copy exactly the curvatures that existed in the natural dentures. They may or may not have been correct. Even if correct for the natural dentures, they would be unsuitable for the artificial restorations, which have no individual fixation of the teeth.

The object is to establish a new prosthetic curve that will balance the dentures perfectly, nullify the anterior component and give a vertical direction to the force of mastication.

FUNDAMENTALS

Sufficient knowledge is essential to understand in a general way how the three primary fundamentals, anatomy of the mouth, jaw movement and facial divisions, aid in establishing the correct occlusal curves. The more exact the knowledge, the better the operator will be fortified. In other words, the knowledge of the three primary fundamentals is the guide in determining the correctness of the curves. More specific knowledge is necessary in understanding the additional fundamentals, which are: establishment of the divisional point between the occlusal surfaces of the upper and lower bite blocks, location of the condyle center, establishment of the

Wadsworth basic line, face-bow assemblage, adjustment of the articulator, prosthetic curves and adjustment of the condyle paths to harmonize with the curves.

DIVISIONAL POINT

In developing the divisional point between the occlusal surfaces of the upper and lower bite blocks, many factors influence its location, and particular attention must be exercised in determining its exact position. The location of this divisional point is an important factor in establishing the curves. From this point, the distances to the condyles and radical center are established, and it is also the point from which the curves take their beginning. During the process of the establishment of this point, the vertical relation of the two jaws and centric occlusion is approximately fixed.

CONDYLE LOCATION

Any of the methods advocated may be utilized in locating the condyle head, but no matter which method is employed in determining the position, it is of the utmost importance, in establishing the location, to be as accurate as possible. The point indicating the condyle head is equal in importance to the divisional point established between the bite blocks, and a line projected from the divisional point to the condyle head forms the base of an equilateral triangle, the vertex of which establishes a point from which the curves of occlusion are scribed on the face of the bite blocks. The point is also the terminal of a line projected from a point located midway between the outer canthus and the lower corner of the nasal fossa, and the line thus formed is the Wadsworth basic line.

TECHNIC

The condyles are usually found about one half inch forward from the external auditory meatus and can be felt by holding the fingers over this point while the patient opens and closes the jaws; or on a line drawn from the external auditory meatus to the outer canthus about one half inch in front of the meatus. The position should be marked with a small disk of black court plaster, for readjustment if necessary.

WADSWORTH BASIC LINE

From the lower corner of the nasal fossa to the outer canthus, and from the outer canthus to the condyle center, and from the condyle center back to the lower corner of the nasal fossa, Dr. Wadsworth located a triangle which he designated as the naso-optic-condylar triangle. By longitudinally dividing this triangle by a line drawn from the condyle center to the center of the line connecting the naso-optic points, he established a line which he utilized as a basic datum in connection with the "T" attachment of the face-bow to form two sides of a rectangle. This rectangle is reproduced and completed in the architectural design of the frame of the articulator itself, so that, with the face-bow equipment and "T" attachment, the orientation of models within the rectangle of the articulator in the exact relative position occupied by the trial plates in the mouth is assured.

FACE-BOW ASSEMBLAGE

The data obtained in establishing the divisional point, condyle location and Wadsworth basic line are used as a basis to adjust properly the face-bow assemblage to the head. The face-bow, with the Wadsworth "T" attached, is the means by which a transfer of the assem-

blage of the bite-plates from the mouth of the patient to the articulator is made. The face-bow transfers the case in anteroposterior and lateral relationship. The Wadsworth "T" attachment transfers the case in a horizontal and perpendicular relationship.

ASSEMBLAGE TECHNIC

The mouthpiece is removed from the face-bow and its semicircular fork is heated sufficiently to permit it to be inserted into the body of the anterior surface of the upper bite-plate just above the occlusal plane, so that the stem will project horizontally therefrom in the median line, and be parallel to the occlusal surface of the bite-plate. A slight variation from the indicated location of the fork will be of no consequence, as the universal joint will accommodate itself to the variation.

The heads of the condyle bars of the face-bow are set in such way that their inner ends will pass easily over the cheeks of the patient to the points indicating the location of the condyle. The scores are counted on the bars and the heads set an equidistance from the ends of the bars. The condyle bars are fixed in this position with the clamp nuts provided for this purpose, so that, in removing and readjusting the face-bow to the bite-plates in the patient's mouth, the position of the condyle bar heads will always be maintained.

The upper bite-plate is placed with the fork attached firmly in position in the patient's mouth, an adhesive being applied to the palatal surface to assist in keeping the bite-plate stable. The lower bite-plate is then placed in position and the patient instructed to close the jaws in order to hold the bite-plates firmly together when the face-bow with its attachment is adjusted.

The operator takes a position behind the patient and adjusts the face-bow to the face by directing the stem of the mouthpiece, which is projecting forward from the anterior surface of the bite-plates, into the opening provided for it in the adjustable clamp attached to the bow. The condyle heads of the condyle bar are placed directly over the position marked as the condyle location. The patient is instructed to grasp the crosspiece of the clamp screw to support and aid in obtaining the adjustment. With the fingers of each hand supporting the heads of the condyle bar in their proper position, the patient is directed to turn the screw sufficiently tight to support the applicance in this fixed position until its correctness is observed and the adjustment completed.

The Wadsworth "T" attachment is placed in the extra clamp attached to the bow. The crosspiece is adjusted to parallel the Wadsworth basic line extending from the condyle location to the divisional point of the naso-optic line. In the normal profile, one not having a protruded or retruded mandible, the standard of the "T" attachment thus adjusted will also approximately parallel an imaginary line from the glabella to the symphysis menti. The completed adjustment of the Wadsworth "T" attachment represents one angle of the rectangular form of the articulator which coincides with the same angle of the rectangle projected on the head of the patient as previously described. Both clamps are firmly secured and the face-bow assemblage carefully removed from the face to avoid displacement of any of the parts in the transfer from the face to the articulator.

ARTICULATOR ADJUSTMENT

The articulator is a machine designed to embody in its construction all of the features considered essential to reproduce in its makeup the basic datum taken from the face. It provides for adjustment of the condyle paths to suit each individual and also affords a means for accurately establishing the radial centers of the circles, arcs of which are the individual prosthetic or engineering curves for each side of the mandible, as in cases of asymmetric mandibular development.

ADJUSTMENT TECHNIC

The distance between the heads of the condyle bars obtained when the face-bow was fixed in its proper position on the patient's face is measured. The set screws of the condylar distance collars are released so that they may slide easily on the condyle bar. The lock nuts of the condyle standards are released, and, with the condyle standard adjusting screws, the distance between the two condyle standards is adjusted to the desired measurements (as determined by the face-bow less 1 inch). Care must be observed to bring them in or out equidistantly from the 4-inch mark on the instrument base on both sides, with the graduation on the articulator base as a guide. Having adjusted the condyle standards to the desired distance, the operator fixes them firmly in position with the condyle standard lock nuts.

The incisal guide planes are adjusted at an angle of 20 degrees and the point of the incisal guide pin is brought to a position exactly in the center of the incisal guide planes. Then the condylar distance collars are adjusted firmly against the condyle disk with the milled head of the set screws pointing forward. These two preliminary steps in the adjustment of the articulator are most important, the condyle standards determining the position of the condyle in the glenoid fossa and the condylar distance collars maintaining the incisal guide pin in central position throughout the whole procedure of articulator manipulation.

PROSTHETIC CURVES

If the prosthetic curves of occlusion established artificially are to be of any practical value in imitating the human masticatory apparatus, a complete harmonization of the movements of the mandible and condylar heads in the glenoid fossa with the planes of occlusion is absolutely essential. The addition of this feature in the mechanism of the articulator which provides a means to reproduce the curves, along with the "T" attachment which properly orients the models, enables one to see clearly the wonderful possibilities lying in a practical application of the machine. The importance of the prosthetic curves in equalizing masticatory stress and the part they play in producing the harmonization of the curves of occlusion with the movements of the condyle in the glenoid fossa demand attention to the need of establishing accuracy in following the technic of scribing the curves in each individual case.

TECHNIC OF SCRIBING CURVES

The radial center place is heated and the depression filled on each side with soft black tray compound. The compound is spread with the fingers as smoothly as possible and the finish completed by pressure between two flat surfaces until the surface of the compound is flush to the rims.

With a pair of dividers, the distance

is measured from the mesio-incisal angle to the condyle center. Then, with one point of the dividers on the condyle at the junction of the slot and condyle disk, an arc is scribed on the modeling compound on the centering plate. One point of the dividers is placed at the mesio-incisal angle, and another is scribed on the centering plate. These two arcs will intersect, and the point of intersection will be the vertex of an equilateral triangle, the base of which is a line between the mesio-incisal angle and the condyle center.

The mesio-incisal line is the furthermost forward point of the maxilla and mandible, and the condyle is the most distal point. Therefore, the vertex of the triangle described above becomes the exact center of the curves of occlusion. A point of the dividers is placed at the intersection of the two arcs on the centering plate and an arc scribed on the face of the bite blocks. This arc is the prosthetic curve of occlusion.

The procedure is repeated on the opposite side.

The lower bite rim is cut away or added to until it conforms to the prosthetic curve scribed. Then the upper bite-plate with the models attached is removed from the articulator. The articulator is closed, and holding one point of the dividers at the vertex of the triangle, the operator gouges deeply into the occlusal surface of the lower bite rim laterally with the other point of the dividers. This will register the trend of the lateral curve. The occlusal surface of the bite rim is trimmed to the depth of the marks so made. The operation is repeated on the opposite side. The upper bite-plate with model attached is replaced, and the occlusal surface of the upper bite rim built to conform with the planes established on the occlusal surfaces of the lower bite rim. The arcs established will coincide with the individual measurements of the distance from the mesio-incisal angle to the condyles. This is a most important attribute of the Wadsworth instrument, which makes it possible to take practical advantage of the well established anatomic fact that the two sides of the mandibular triangles are rarely of equal dimensions.

A groove is cut in the occlusal surfaces of both the upper and lower bite rims, one eighth inch or more in depth, extending from one posterior border to the other, and the rim of the groove on the buccal, labial and lingual portions of the bite rim wax is allowed to maintain the proper bite distance. The groove is undercut throughout its full extent. A mix of plaster and carborundum, approximately equal parts, is placed in the grooves and is built up about 1 mm. above the wax edge of the bite rims. After the mass has set, the bite-plates are placed in the patient's mouth and the patient is instructed to perform the masticating movements in every possible direction. The patient is allowed to continue the movements until the planes are milled to the wax edge of the bite rims, which represents the original bite. They will then be in perfect occlusion in every position that the mandible of the patient may assume.

ADJUSTING THE CONDYLE PATHS

The milling of the planes gives absolutely correct individual prosthetic curves, a closer adaptation of the upper and lower occlusal planes, a better surface on which to arrange the teeth and a means for checking the accuracy of the work done thus far. Milling of the planes eliminates all elements of error

due to the personal equation in taking measurements and also assures the harmonization of the movements of the mandible with the movements of the condyle in the glenoid fossa, because the angle of the condyle path on the articulator is established from the perfectly developed prosthetic curves.

ADJUSTMENT TECHNIC

The incisal guide pin is removed, and the anatomic movements of the articulator are thus dependent solely on the milled occlusal surfaces of the perfected prosthetic curves. The condyle-path-adjusting set screw is loosened on one side, and, with the condyle adjusting screw, the occlusal surface of the upper bite rim is moved across the occlusal surface of the lower laterally, until the two surfaces begin to show a separation. The condyle path is adjusted by turning the condyle disk backward and forward until no movement of the upper bite-plate is perceptible. The condyle path is locked in position with the condyle-path-adjusting set screw, and then, with the condyle adjusting screw, the condyle bar is allowed to return to position, resting against the condyle rest position screw. The procedure is repeated on the opposite side, and the angles of the condyle paths will be set in harmony with the prosthetic curves of occlusion.

BENEFITS DERIVED FROM ESTABLISHED PROSTHETIC CURVES

The benefits derived from the establishment of prosthetic curves are as follows:

1. A means is provided for establishing centric occlusion by milling in the bite blocks.
2. By nullification of the anterior component, greater stability of the dentures is assured.
3. More resistance to the force of mastication is produced because of the vertical direction of the teeth.
4. The movements of the mandible are harmonized with the movements of the condyle heads in the glenoid fossa.
5. The pressure under biting stress is equalized owing to the milling of the planes.
6. The method of arranging the teeth is simplified and perfect balance of the finished dentures is established.

HISTORY AND PRESENT STATUS OF RESEARCH IN PERIODONTITIS*

By NEWTON G. THOMAS, M.A., D.D.S., Pittsburgh, Pennsylvania

FOR a long time, I have believed that a synopsis of the progress of dentistry is a needed undertaking to enable a quicker finding of the specific contributions of dentistry, as well as to give the present tenets of dental faith for ready and accurate reference. I promised myself the pleasure of the task in certain fields and hoped to attract other workers to the subjects of their liking for the same purpose, so as to shorten the time element as well as bring better understanding to the subject to be reviewed. This statement, then, savors somewhat of that plan but is too immature, too hurriedly done to measure up to the original intention. Frequently, we stumble on some very modern discovery or practice, in what might well be called quite ancient literature. Too often we do not go far enough ancestrally when compiling our bibliographic reviews or we should not make many of our claims. It was this fact that lured me to the program outlined, as well as the reasons stated before. Far better productions than this can hope to be have already been made that cover the period of this paper. I would call your attention to a work by Dr. Dewey,[1] as well as one by Dr. Prinz.[2] In reality, there is no need for this paper at this time save for the value of a personal presentation in comparison with a written one.

In spite of the term used in the caption of this paper, I shall use the old and generally employed form pyorrhea alveolaris in the progress of this article. I am fully aware of the inadequacy of the term. I know how inappropriate it is to the conditions it is supposed to describe, but still I use it. And this is my reason: It is so commonly, so widely accepted and used, it would be hard to change. I suspect it will never be changed. In similar inaptitudinous usages, we have to make changes, to find that our efforts are in vain. Witness the tenacity of the word cell designating the unit of tissue structure. It is crudely inapt, and many have tried to replace it with more accurate word forms but still it stays. I doubt, however, that any one employing it ever thinks of the suggestion it made to those who initiated it. It is easier to allow the words to take on new meanings with the newer findings of research than it is to adapt word forms to each newly found tissue influence or variation. And that is more normal to language processes. We accept such incongruities

*Read before the Chicago Dental Society, May 18, 1926.

1. Noyes, F. B., and Dewey, Kaethe W.: A Study of the Pathology of the Peridental Membrane, J.N.D.A., 4: 375 (April) 1917.

2. Prinz, Hermann: Dent. Cosmos, 68 (Jan.) 1926.

daily, for the most part unwittingly; hence, the continued use of this misnomer. Such a language habit alone could tolerate the combination of "dry pyorrhea."

The foregoing scarcely condones such a monstrosity as periclasia. This is a combination of alphabetical forms minus any mental concept. Imagine what a person unfamiliar with dentistry would do were he to happen upon such a jugglery of letters! The word applies as well to the capsule of the liver as it does to the investing tissues of the teeth. It is a dental term only because dentists use it.

In accord with the suggestion made, a definition of the disease under discussion might be attempted. Prinz says, "Pyorrhoea alveolaris may be defined as a mechanical interference with the physiologic absorption of the paradentium accompanied by an excessive proliferation of the detached external epithelium at the point of its union with the remaining enamel cuticle." Hopewell-Smith defines it as follows: "Literally, a flowing of pus. It is a symptom or sign of an infective condition of the sockets of the teeth. It is accompanied by a slow wasting or atrophy of the alveolar processes of the jaws, and may be attended by the formation of tartar and gradual and progressive loosening of the teeth. It is generally painless and is not necessarily inflammatory in origin or in consequence." And similar to this are the others, later writings, the long list of symptoms and variations housed under the term being innumerable. A great many names have been employed for designative and elucidative purposes.

A review of the literature for no more than twenty years indicates some interesting changes of attitude as to the etiology of pyorrhea. In his "Special Dental Pathology," published in 1915, Dr. Black says, "I cannot today believe that more than a limited number of cases originate from systemic causes." In the same chapter, he disposes of Witzel's alveolitis theory, because, he says, "the alveolar process is the last of the investing tissues to become involved." In 1903, Hopewell-Smith says, "The disease develops not primarily in the bone but begins with a suppurative inflammation of the gums which approaching the bone gradually produces osteitis rarefaciens." In 1918, he says, "Pyorrhea alveolaris is essentially dependent on an osseous lesion, an atrophy of the bone." Dr. Black emphasized the effectiveness of calculus as a cause. Smith writes that "the presence of calculus is not sufficient to induce the conditions." Both Black and Smith, in those earlier writings, noted the possibility of the systemic cause. As the causes stand for and obtain recognition today, we find five receiving especial attention. To these causes, groups of students have attached themselves with considerable devotion. The theories named are: (a) the calcic theory; (b) the infection theory; (c) the occlusal stress theory; (d) the theory of constitutional disturbance; (e) the alveolar atrophy theory.

A brief review of these theories is well in place. Black was perhaps the most influential exponent of the calcic theory of the origin of this disease. The presence of salivary calculus was suspected of producing inflammations in the gingiva, which, in turn, gave rise to the serumal exudate that produced the calcic nodules found attached to the tooth surfaces in the gingival space. Prinz concedes that the supragingival calculus, and subgingival calculus are,

or may be responsible for, gingivitis, but he repudiates the serumal calculus as a distinct entity. He says that there is no serumal calculus but contends that all calculus is salivary, and adds that no calculus is ever found in the bottom of the pyorrhea pockets. It is most evident that the calculus forms a large part of the irritative circle maintaining the exudation and further calification.

For thirty years, there has been a search made for a specific causative organism of this disease. This hypothesis that some specific bacterium or symboisis of bacteria is responsible has perhaps fewer supporters than any of the other hypotheses. Always, the bacteria found in these studies are of a mixed order. The elimination of any of the bacteria fails to check the ravaging disease.

Abnormal occlusal stress as a theory has developed many disciples. Like the bacterial theory, it has been before the profession in varying activity for thirty years. The last decade has given it a sort of renaissance by comparison with its previous activity: Karolyi, of Vienna, is accredited with the authorship of the idea, in 1894, to be followed by Bonwill, in 1898. To him is ascribed the statement that "usually three-fourths of the necessary treatment is to get thorough articulation of the teeth." The last decade has developed an extensive literature on the subject. The devotees of the theory seem, for the most part, to be empiricists, being completely satisfied with their ocular observations. The major emphasis seems to them to be clinical. In 1905, the Hungarian Dental Society appointed a commission to test the claims made for this supposition. Among the results of the study that negated the hypothesis were these: People who grind their teeth during sleep do not necessarily develop the disease; abnormal stress in malocclusions was noted with no evidence of pyorrhea; pyorrhea was present in instances of normal occlusion; in teeth free from abnormal occlusal stress because of the absence of opposing teeth, pyorrhea was present; teeth standing singly, having to bear much stress, were not attacked by pyorrhea. Black called attention to the fact that the posterior teeth, which bore the brunt of mastication, were most liable to the disease, but this, to his mind, was not due to the stress, but to the loss of contact from abrasion or movement that resulted in injury to the gingival tissues.

The theory of constitutional disturbance and that of alveolar atrophy seem to be most intimately related. Clinicians report, with much uniformity, that certain diseases predispose to pyorrhea. The most commonly named are diabetes; gout; diseases of the kidney, liver and heart; tabes, and anemia. Pregnancy is betimes mentioned as a predisposing cause as well. Claimants for these premises all protect themselves with the phrases of uncertainty common to science. That these diseases are such is still a subject for serious study, and there is left much room for closest observation of these syndromes before anything specific may be proclaimed.

A large number of names are associated in support of the alveolar atrophy theory. Principal among these are Talbot, Roemer, Znamensky, Hopewell-Smith, Fleishmann and Gottlieb, Weski, Lang and Box. Perhaps the major contribution was made by Fleishmann and Gottlieb, in 1919. They picture the atrophy of the alveolar process, after which the epithelium that normally lies against the enamel surface attached to the enamel cuticle releases its attach-

ment, thus creating an actual space which, previous to this time, did not exist. To state otherwise: The gingival space is not a normal, anatomic feature of the paradontal tissues and the teeth. Its formation invites bacteria and food elements and calculus, which establish inflammation. With the absorption of the alveolar crest, the epithelium of the space thus created penetrates the peridental membrane next to the tooth surface, and, again, in response to the invasion of the increasing depth by the agents mentioned above, grows deeper indefinitely, or better, until such a time as the absorption or atrophy of the alveolar process, for any reason, ceases. The atrophic changes taking place in the alveolar process are the result of some unknown constitutional factor. These workers concede that inflammatory processes progressing toward the bone may hasten the removal of that tissue. Landgraf, in 1911, made a drastic differentiation between the courses run by pyorrhea abetted by constitutional disease and that having local causes only. Since the work of Zilva and Wells, many have shown conclusively that the absence of certain vitamins is productive of atrophy of the alveolar process and consequent dystrophy of the peridental membrane.

Hopewell-Smith contends that alveolar atrophy need not be the outcome of pathologic disturbance but may be the result of senile change, which, he states, is the natural concomitant of age. The idea is that the loss of the supporting bone constitutes a part of the general lowering of functional activity and waste of tissue. Such a condition occurs in more youthful mouths, and is then named atrophia alveolaris praecox. Owing to this waste of the osseous support, the gingivae sag from the teeth, which makes a gaping trough around them, and invites injury and infection. As the cause of this condition is unknown, it is vaguely attributed to neurotrophic disturbances. In this case, as in the cases of Gottlieb and Fleishmann, gingival irritations add their influence to the loss of alveolar bone.

No statement that has been made is truer than that the origin of pyorrhea is unknown; and no conclusion could be more evident from the perusal of the literature. As a result of this, a simple classification of believers has been made. They fall into three groups: those who think the causes are entirely local; those who think the causes are entirely constitutional; those who attribute the disease to combined local and constitutional causes. Evidently, the last named are on safe ground. Their position gives them a sword that cuts both ways. Also, this position affords explanation for both curable and incurable conditions. If a local treatment results in cure, the cause is local; if it fails, the cause is constitutional. An accidental but fortunate change in systemic conditions would be misleading, to say the least. Whatever the cause of the disease, it is true that it is cured by the extraction of the affected teeth, a fact which indicates strongly the susceptibility of the tissues that support the teeth to either constitutional or local disturbances. Obviously, a systemic condition that abets paradental degeneration might be existent and escape diagnosis. This evidently is the explanation of the statement made that pyorrhea may exist with no evidence of either local or general disturbances.

Let us reread a few statements made by leading contributors to this subject. This is done only to give you a definite

vision of the *status quo* of our knowledge of this insidious disease. "In summarizing the various theories which at present are recognized as etiologic factors of pyorrhea alveolaris, the theory of alveolar atrophy combined with the enumerated theories as contributory agencies offers the most plausible explanation of the etiology of the disease." (Prinz.) "Systemic causes are seldom primary except in cases exhibiting scorbutic symptoms." (McCall.) Again, McCall states, "The primary cause is almost entirely mechanical and therefore local." Concerning the symptoms of the disease we read statements such as these: "Genuine pyorrhea without pockets does not exist." (Prinz.) The pocket," Prinz continues, "is the sine qua non of existing, genuine pyorrhea. The pocket is the absolute pathognomonic clinical symptom of the disease." Over against this, put the following: "Many cases of pus flowing from the sockets of the teeth are not pyorrhea alveolaris but are frequently incorrectly described as such." (Smith.) Other authors state that the disease develops with no such phenomena associated with it.

Another item of interest in this field is the expressed occurrences in the paradontic tissues during both the process of disease and those of recovery. Phrases abound that express the phantom hope of those who make them. "End-arteries" are mentioned to throw a mystic charm into the degeneration problem; but, at this moment, no such arteries have ever been demonstrated in these tissues. We read of "functional atrophy of cementum." Certainly, no one who knows the anatomy of cementum could express such an impossibility as atrophy of any sort in this tissue. The adjective and substantive form a strange union—functional atrophy! Absorptions and hypercementoses are spoken of as subsequent to infections. The stimulus from an advancing injury may well give rise to either absorption or cementogenesis, but such could scarcely be expected after pus formation. Reattachments to new cementum are spoken of as commonplace. When a secondary cementum partially fills a foveola made by osteoclasts, the indifferent tissue that fills the space and forms the matrix of the cementum is not peridental tissue, in the sense that it forms fibers of attachment. The principal fibers are formed in response to environmental need during the development period. Such a condition is never reproduced during the adult life of the tooth. Similarly, we read betimes of restoration or rebuilding of the alveolar process. New bone may readily be added hyperplastically to the remnant of process that remains, but the formation of new process is a will-o-the-wisp. That bit of anatomy is constructed in response to the erupting tooth; a piece of history that never repeats itself, hence leaving alveolar reconstruction a most questionable possibility. How, then, may we hope for its reconstruction? Such items as these have no place in scientific literature, but others like them abound. They are the results of persistent hope and indifferent knowledge of the sciences fundamental to the tissues in question.

The program of research in this field is still a long one. It is likewise an alluring one. The most evident need seems to be a definite program that shall combine both local and systemic observation by competent men. It seems quite evident that something more than microscopic observation must be made to prove the epithelial-

enamel cuticle relationship to pocket formation announced by Fleishmann and Gottlieb, and quoted with such assurance by others. Obviously, such a program cannot be carried out sporadically, but must be the work of groups rather than individuals. The biggest obstacle in the path of the successful attack is the inadequacy of college equipment to carry it through. I say college because the college is the only institution available to us for such endeavor. The seriousness of the labor spent on the subject in recent years is the most encouraging fact of recent dental history. But to repeat, and to close with the repetition: The task is not one for an individual but for a coordinated group. It is not one for indifferent laborers but for men trained of mind and hand who can think straight and work with precision. The problem may be long, but science refuses to believe that its solution is impossible.

DENTURE IMPRESSIONS UNDER CONTROLLED PRESSURE*

By ARTHUR H. BROWN, D.D.S., Denver, Colorado

TO paraphrase: "Esthetics, balanced occlusion and adaptation, but the greatest of these is adaptation." A denture is serviceable, satisfactory and salable in proportion to its adaptation, or, as the laity express it, the "fit."

Esthetics, balance, proper bite opening, central occlusion, condyle paths, occlusal curves and the proper directioning of force are highly desirable in any denture, but adaptation is essential and its attainment well worth the time, study and care required on the part of the operator. He should be familiar with several impression technics and should use such parts of one or more as promise the best results in the case in hand.

In a general way, the impression that it is most difficult to remove from the mouth is the one furnishing a cast from which the best adapted base may be expected. This may not be the case where ridge conditions make for mechanical retention of the impression, and in mouths in which there is thick, viscid saliva, a poor impression might be difficult of removal. But in mouths ranging from average to poor, the best results will be obtained from the impression that sticks.

The impression having the best adaptation will be the one having the greatest retention. The impression having maximum retention and therefore requiring the greatest amount of force for removal will be one resulting from the predetermined, uniform, simultaneous pressure of a fluent material on all of the impression area and with all of the tissues within that area at rest in their normal position; that is, all of the tissues within that impression area must be submerged in a material so fluent as to be incapable of distorting or displac-

*Read before the Section on Full Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

ing the softest tissue and, while so submerged, must have external pressure applied which will insure absolute contact of the material with the tissues.

This pressure must be maintained until the material has hardened past the flowing stage. In displacement of the soft and semirigid ridge tissues in securing the impression, two sources of trouble in the finished denture arise: one from the tendency of the tissues held out of their normal position by the impression, and therefore by the denture, to return to the normal position, carrying the denture out of its proper seat. The other from the denture's continually playing on the parts held in an unnatural position, causing irritation and often extreme soreness.

The softest tissue cannot be compressed or condensed; that is, caused to occupy less than its normal amount of space; but soft tissue, and even comparatively firm tissue, will flow under pressure. When I press on the fleshy part of my hand, I seem to compress the soft tissue, but, in reality, there is a compensating bulging of the tissue contiguous to the point of pressure so that the general surface level or datum level is not disturbed. It should be noted, too, that the bulging force is equal to the force directed inwardly, less friction. If I make inward pressure of one-fourth pound on one-fourth square inch of surface, there will be a bulging force of 1 pound per square inch of surface effected, less the force required to overcome friction. The same action occurs when we attempt to adapt compound to soft tissue, section by section. The tissue under pressure flows somewhere, and with force enough to affect the already adapted compound in many cases. Then, when pressure is released, the tissues exert a force toward their rest position, leaving spaces where the flow has been and with a tendency to bulge at the point where pressure was made, the spot where the sore place is going to be under the denture.

An allover impression taken under reasonable pressure, up to one pound per square inch, when reproduced in a denture base will not cause discomfort to the patient or atrophy of the tissues with consequent loosening of the denture.

Soft, flaccid tissue encased in a perfectly fitting denture base will resist ordinary pressure brought on that base in a seating direction, without traumatic or irritating effect, if the tissue were in normal, rest position when the impression was taken.

To obtain this universally applied pressure over the whole denture surface simultaneously, I secure a peripheral adaptation outside and beyond the dentural periphery, leaving the denture area entirely free from contact. The space inside the peripheral dam is then filled with plaster in a fluent state, which is forced into absolute contact with all of the denture surface by the application of air pressure from without. The apparatus required for the operation is small and simple, consisting of an ordinary impression tray modified by having a one-sixteenth inch tube inserted in a hole in its labial border, 3 feet of one-eighth inch rubber hose and a small tank for the storing and dispensing of air. The tank has two compartments, a larger one below for storage and a smaller one above for equalizing the pressure delivered through the rubber hose to the impression. One needle valve, controlled from the top of the

tank, serves for filling the tank as well as for releasing the air into the hose leading to the work. A pressure gage, attached to the top of the tank and connected with the upper compartment, indicates the amount of pressure in use at any time.

TECHNIC

For convenience, I shall first describe the technic for securing a maxillary impression. After the usual examination of the mouth is made and the findings are recorded, a snap impression is taken and a model is made. Over this model, a heavy base is formed consisting of two thicknesses of baseplate wax, of approximately the same peripheral outline that the finished denture will have. The outer periphery of this wax base is beveled to a feather edge for convenience. A tray, modified as described, is selected, large enough to fit loosely over the wax base and pass well up to the border tissues. The wax base is placed in the mouth. Softened compound of about one-fourth inch thickness is placed in the tray and pressed to place in the mouth over the wax base, extending beyond the margin of the base in all directions, and forcing the border tissues and the soft palate to their highest positions. The impression, carrying the wax base, is removed from the mouth, and if at any point the compound has not reached its highest possible position, more compound is traced on the border at that point and the impression is returned to the mouth. This is repeated until satisfactory adaptation is secured to the border tissues and soft palate at all points. Adaptation to the palate should be well back of the line to be assumed by the posterior border of the finished denture. No attempt is made at muscle trimming at this time. A satisfactory peripheral adaptation having been secured, the wax base is removed from the impression and a hole is made through the compound to connect with the tube in the rim of the tray. This hole is countersunk inwardly, and a small ball of wax is placed therein to exclude plaster when the final impression is made. This wax does not interfere with the inward flow of air through the tube but is blown slightly inward, allowing the air to enter beside it. The impression is flowed with a mix of plaster so thin as to be quite fluent; the hose from the air tank is attached to the tube through the rim of the tray; and the impression is placed in the mouth and held firmly in place with a pressure of 5 or 6 pounds, while an assistant opens the needle valve of the air tank until a pressure which has previously been decided on is registered on the air gage, this pressure being maintained until the plaster has crystallized past the flowing stage. A registered pressure of 1 pound or less is sufficient in most cases. When the plaster has hardened sufficiently, the impression is removed from the mouth. If the technic has been carefully carried out, it should be quite difficult to remove the impression by the ordinary means. It may be removed easily thus: The rubber hose is removed, and a long sharp instrument is introduced into the tube and carefully worked through the compound and plaster until it is felt by the patient. The hose is replaced and, with 5 or 6 pounds of air pressure, the impression is blown loose instantly and painlessly. It is always possible to know whether the impression is a good one or not. If there has been no leakage of air over the border of the im-

pression, when under pressure, and if there are no air bubbles on the surface of the impression owing to carelessness in inserting tray, there can be no doubt as to the adaptation.

A cast is made of any material desired, and over this cast, a base is formed of impression tray compound, and a bite-rim built up of wax or compound. This is used in the usual way for securing the muscle-trimmed periphery of the impression. The exact outline to be given the posterior border of the denture is also determined at this time, by softening the base at its posterior border and allowing the palate muscles to turn it down until their free movement is no longer interfered with. The buccal and labial borders are trimmed to about one-eighth inch thickness and the base replaced on the cast. Any good plaster, mixed rather stiff, is built on to the cast around the margins of the muscle-trimmed base. When this plaster has fully set, the base is removed, leaving a muscle-trimmed cast.

The technic of securing a mandibular impression differs but little from that of a maxillary impression. Good results cannot be obtained below the mylohyoid ridge as it is impossible to get a good peripheral seal at that point. Sometimes, just before placing the tray in the mouth for the final impression, I place a roll of very soft wax (such as is used at the tooth counter for attaching teeth to casts) in the valley in the impression corresponding to the mylohyoid ridge, and I often find that I have a good impression as far below the ridge as the patient is able to wear the denture. In cases in which I desire a very deep impression, I make the impression as described, and then, by the addition of compound, secure the impression of the soft tissues below the ridge.

THE FIRST PERMANENT MOLAR*

By W. D. N. MOORE, L.D.S., D.D.S., Chicago, Illinois

SUSTAINED interest in any subject is the best evidence of its importance, and the application of this truth is most fitting to the topic of our discussion this evening, the first permanent molar. It requires some degree of courage to prepare a paper today on a subject that has been so long and so fully discussed as this. The tendency of the present day is to exploit some new idea whether or not it is fundamentally sound, as long as it is capable of producing a thrill or furnishing something of a spectacular nature. In spite of all that has been said of the first permanent molar, much still remains to be said if this difficult problem is to be most satisfactorily solved. The loss of the first permanent molar introduces one of the most powerful forces for the detriment, and even devastation, of the human mouth.

There is no gainsaying the fact that no other tooth in the dental arch plays so important a rôle as that of the first permanent molar. Erupting among the earliest of the second dentition and without any disturbance, as a rule, to the deciduous teeth or the gums, it boldly and definitely takes a position in the arch, the significance of which cannot be too fully realized or appreciated if a well developed permanent dentition is to be maintained. A study of Nature's plan for the function this tooth is to perform is most interesting and fascinating, and, when thoroughly understood, it should awaken the keenest sense of responsibility, in view of the many considerations that are likely to be encountered if the tooth is to render the maximum service to its host.

All teeth are important organs of the human mouth and their conservation is imperative. The lot to which the first permanent molar is heir is in many respects different from that of any of the other teeth. Its eruption and presence in the arch are so frequently unknown to the parent or guardian of the child, and not being under the regular observation of a dentist as it should be, it is frequently mistaken for a deciduous tooth, and no attention is given it until serious inroads of decay occur. Until the average parent is better enlightened initial injury to this tooth can be expected. Frequently, faulty development of this molar offers a predisposing cause of dental caries, and this liability is often enhanced by an offending neighbor in the adjacent deciduous molar whose surfaces do not present a clean and healthy environment. With these handicaps, more or less present, this tooth is born to perform its functions in the dental arch, which are at least twofold, and each equally important for the future permanent dentition.

*Read before the Odontographic Society of Chicago, Dec. 13, 1926.

First, and naturally so, we think of its function in mastication, and realizing at times certain prevailing conditions under which it labors, the marvel is its survival and endurance. It is not uncommon, when the deciduous teeth have been lost prematurely, to observe that the entire stress in the posterior part of the arches is borne by the four first permanent molars and practically all the mastication is done on these teeth. Particularly in the transition period do we find an extra burden placed on the first permanent molar. It undoubtedly becomes the chief organ of mastication with a larger and more effective occlusal area. But its function does not end here: it maintains the stability and integrity of the arches in a manner that no other tooth does. Erupting normally before the loss of the deciduous molars, and in the proper position, the first permanent molar becomes the veritable cornerstone and central pillar of the human mouth. It is the generalissimo of the dental organs.

Fig. 1.—Loss of first permanent molar, before and after operation; showing method for correction.

Recognizing, then, the important functions and valuable service the first permanent molar performs in the human mouth, we as dentists should readily realize that its loss cannot fail to be productive of the most unfortunate results unless early treated and corrected. Its effects are so far-reaching that it is difficult to deal fully with all of them here. The age at time of loss of the molar, the duration of its absence, the manner in which the teeth occlude and articulate are all capable of producing an endless number of conditions, each one different from the others, but all similar in their destructive influence. From the very first day the molar is lost, there at once begins a drifting and migration of some or all of the teeth on that side of the mouth, with the usual elongation of the tooth opposing the space. With this comes the usual "tipping" of the teeth adjacent to the space a condition that proves ruinous if long permitted to remain.

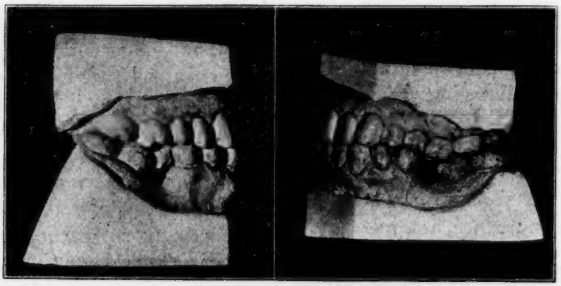

Fig. 2.—Loss of first permanent molar, right and left sides.

The arch becomes less in dimensions in all directions. The loss of the first permanent molar before the full eruption of the bicuspids will lead to a dropping together of the maxilla and mandible and result in too much overbite of the anterior teeth, interfering with the contour of the face and detracting from the character of the countenance. The loss of this tooth at any age results in abnormal occlusion. Even when the occlusion appears to be restored by a drifting together of the second bicuspid and second molar, a model made of the upper and lower will show a faulty occlusion on the lingual aspect. Invariably, there is an elongation of a tooth or teeth opposite the space following the loss of this molar.

The loss of contact point of several teeth, dependent in extent on the age of the patient and the time space has existed, is a common sequence to the loss of the first permanent molar. There is always some loss of the bony structure, and when pronounced inclination and elongation of the teeth occur, an involvement of soft and hard tissues is usually present; and when this condition is long allowed to remain, complete loss of the second and third molar has resulted. Impaired function is the aggravating cause of this loss following the malposition of the teeth. Associated with teeth that are malposed is impaired function, and wherever these are to be found a lack of hygienics can be expected and usually prevails.

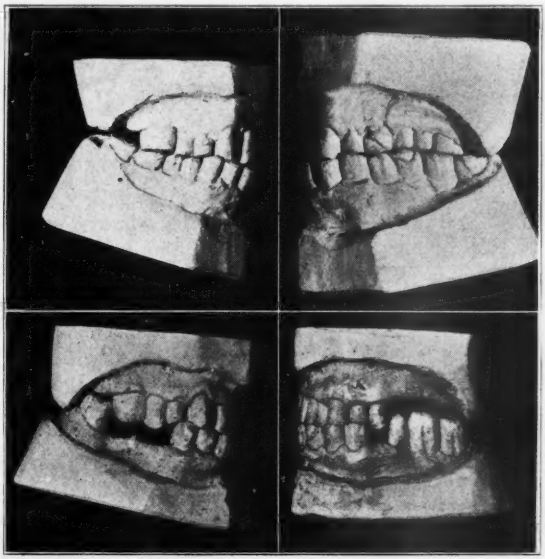

Fig. 3.—Result of delayed treatment after extraction: Above, left: right side; above, right: left side. Postoperative treatment: Below, left: right side; below, right: left side.

If we have a full and definite per-

ception of all the functions intended by Nature for the first permanent molar to perform, together with the misfortune that follows its loss, we cannot fail to be forcibly impressed with the importance that must be attached to this tooth, and our responsibility for its welfare cannot be too earnestly assumed if the greatest good is our goal of service and accomplishment in professional practice.

Fig. 4.—Case presented by a young patient.

Our first efforts, then, should be directed against initial injury to this tooth, which is, and can be, best obtained by frequent observation and prophylaxis. The importance of this is a matter that cannot be too strongly impressed on the parent's mind at the time of the tooth's first appearance in the mouth. When the first break in the continuity of any of its surfaces appears, no delay or temporizing should be tolerated. The idea that has prevailed in many minds that temporary fillings should be employed in filling teeth for young patients is a fallacy, a contention without any good foundation. There is no place in dentistry where work of a permanent nature is more clearly indicated than in the treatment and care of these teeth. The more extensive the decay, the more imperative the demand for permanency, for the reason that contour and contact are so essential to all that pertains to the future welfare of the first permanent molar in the performance of its full function. It is not uncommon to see large proximal fillings in these molars that are soon after insertion so badly disintegrated that all contact with adjacent teeth and contour is totally lost, a shifting of its own position resulting, as well as that of those adjacent to it.

Fig. 6.—Appliance used in correcting the position of the second molar.

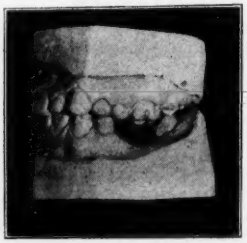

Fig. 5.—Model of case shown in Figure 4, after extraction.

Fig. 7.—Model of case shown in Figure 5, showing second molar restored to correct position.

In such cases as these, it is impossible to maintain the normal position of the other teeth in the arch. No small amount of trouble has resulted from a lack of

Fig. 8.—Second molar in correct position.

observance of these details in first fillings that have been placed in the first permanent molars. Pulp involvement should be strenuously combated in connection with these teeth.

The belief in the minds of some operators that the cavity preparation necessary for permanent fillings in these teeth should not be borne by the child accounts, and rightfully so in certain cases, for much of the temporary work to be seen in the teeth of young patients. It seems that this has often been used

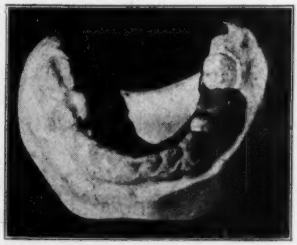

Fig. 9.—Appliance in position on model.

as an excuse rather than a sound reason, and we have allowed ourselves to resort to temporary work for convenience and sometimes economy when it was not truly justified. A great deal of this temporary work has been only a kindness in disguise. The gold inlay has long proved its value and usefulness in operative dentistry and in no place has it been shown to be of greater importance than in restoring permanently, the first permanent molar, within the tolerance of the average young patient. It offers almost ideal advantages, particularly in regard to contour and contact point, both of which are essential in these cases.

When destruction has gone beyond repair and the first permanent molar is to be lost, it is then that the real problem

Fig. 10.—Finished case.

confronts us. Its importance in the dental arch has been emphasized and its loss described and it is therefore not difficult for us to conclude what should be done if we are to conserve the original plan that Nature so well designed for the best welfare of a useful dentition. The greater difficulty lies in how it can best be done. The first thought should be to maintain, as early as possible, the space occupied by the first permanent molar, and this can best be accomplished by the use of a well-made fixed bridge. If the extraction is made when the second permanent biscuspid and second permanent molar are in position, no ordinary responsibility rests on the operator for immediate

means for retaining its space, and this should have been fully planned previously to the operation. It is directly after the extraction that the most rapid movement of the adjacent teeth is made, particularly if the occlusion is such as to favor their migration. Unless considerable movement of these adjacent teeth has taken place previously to extraction, and this is common, owing to cavities or faulty restorations of the first permanent molar, it is good practice to construct the bridge, or at least its greater part, before the first permanent molar is extracted, and place it in position almost immediately on extraction. This precludes the possibility of the slightest movement. But if the adjacent teeth have already lost their normal position owing to faulty restorations, this is not necessary; for their correction of position should first be obtained. More often than otherwise, these cases come to us a considerable time after this molar has been lost, and with various conditions of derangement of the teeth already established; all of which adds to the complexity of the task.

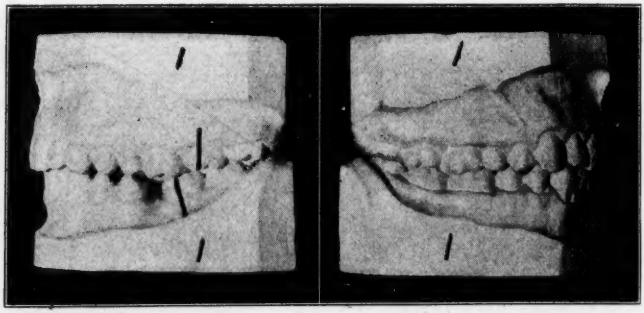

Fig. 11.—Results of early loss of the lower first permanent molar.

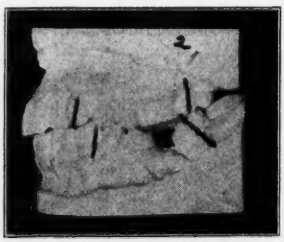

Fig. 12.—Results of early loss of the lower first permanent molar.

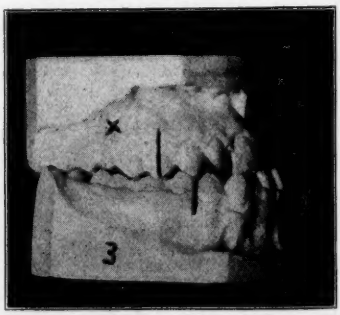

Fig. 13.—Results of loss of the upper first permanent molar.

"Tipping" of the teeth on one or both

sides of the space is a condition not to be overlooked whether it has happened before or after extraction. Before any replacement is considered, particularly in the younger class of patients, their contact with adjacent teeth and their proper occlusion with opposing teeth should be reestablished. In addition to this, bridging inclined teeth for these patients is employing teeth to bear an extra strain at a disadvantage, and will, when done, prove a detriment to them. The more vertical position is the one most suitable and tolerant to the surrounding tissues of a tooth. Therefore, it is only a logical conclusion that those teeth whose positions have in any way been changed by reason of the loss of the first permanent molar should, previously to the use of a bridge for service and maintenance of its space, be placed in a normal position in the arch, even if this is not, strictly speaking, a correct position.

The methods to be used for moving these teeth into normal position, and the age limit advisable for such procedure, as well as many other particulars incident to this operation, can be much more ably covered by Dr. Lourie in his discussion of this paper, since this particular aspect of the subject comes within the field of the orthodontist. I look with much interest for his enlightenment on this side of the subject.

While the treatment following the loss of the first permanent molar in the young patient may extend over a considerable period of time, if properly carried out through its entire procedure it can supply intense interest and a gratification to both patient and operator that is most genuine in character. This is particularly so when compared with cases of long standing in the mouths of patients who are somewhat advanced in years and where correction of position of the teeth is not to be considered. In these cases, the movement of bicuspids and molars toward each other has been so marked that their surfaces often are within a millimeter or two of contact. In many mouths, this is a most aggravating condition, and even when no cavities or fillings are present in the teeth, the only correction can be an operative one, preferably made by the use of the gold inlay in one or both teeth.

Probably the most discouraging condition that we are called on to treat is that in middle-aged patients in which

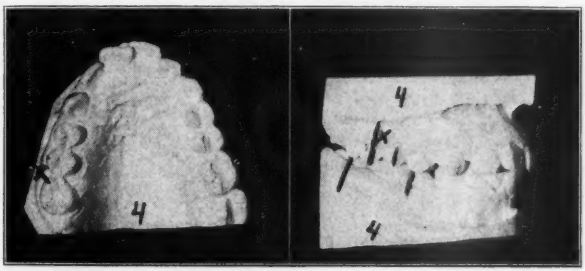

Fig. 14.—Results of loss of the upper first permanent molar.

the bicuspids, and particularly the second and third molars, have not moved so much bodily but "tipped" extensively, with a marked elongation of the upper first molar, and with a history of pain in masticating. The second and third molars may be slightly loosened and no cavities or fillings present. What we accomplished in the younger patient by correcting the position can be only partially gained by operative methods in restoring occlusion by preparing cavities on the proximal and occlusal surfaces of the molars and so shaping inlays that occlusion is corrected with a more upright position given to the natural crowns. Then, by assembling these inlays, which will greatly stabilize the two molars as well as serve as an abutment to carry a substitute for the lost molar, a reinforcement is gained that is of much value. The second bicuspid treated in a manner similar to the molars will supply the anterior abutment. The upper first molar should be shortened and inlayed. Cases of this kind have been made comfortable and serviceable to the patient for many years.

So many and varied are the conditions following the loss of the first permanent molar that there must be several different methods employed if all conditions are to be successfully cared for. The technical detail is in itself a sufficient topic for an evening and one which could better be treated from a clinical standpoint. I should, however, feel disappointed if I could not at this time express my appreciation for the help and cooperation I have received from the orthodontic branch of our profession and Dr. Lourie in particular. For several years, I have been deeply interested in this subject, and the help and interest given me by Dr. Lourie has strengthened my convictions of its importance and stimulated my determination to treat the cases along the lines I have here endeavored to indicate. I wish to express my appreciation to the program committee for enlisting his support tonight on this subject for I feel certain that the greatest good can only come where a close cooperation of all the branches of our profession prevails.

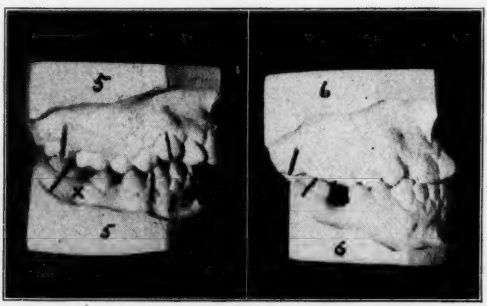

Fig. 15.—Results of loss of the lower first permanent molars.

DISCUSSION

Lloyd S. Lourie, Chicago, Ill.: What importance do you place upon the loss of the first permanent molar in young children, and what should be done in such cases? Dr.

Moore has answered the first question so ably that I shall simply indorse his statements and show a few cases illustrating the damage resulting from early loss of this tooth. Cases 1 (Fig. 11) and 2 (Fig. 12) show results of early loss of lower first permanent molars, while Cases 3 (Fig. 13) and 4 (courtesy of Dr. J. W. Ford) (Fig. 14) show results of the loss of upper first permanent molars. In Case 1, there was at least 50 per cent reduction in masticating efficiency on the side where the tooth was lost. In Cases 3 and 4, the spaces have more nearly closed, but with considerable malocclusion and just as much as or greater facial deformity than in Cases 1 and 2, in which lower molars were lost. Cases 5 and 6 (Fig. 15) show different results after loss of the lower first permanent molars. Possibly in Case 5, the loss occurred earlier, before the bicuspids were in occlusion, allowing them to drift toward the space as well as the second permanent molar, while in Case 6, only the second molar moved. I agree with Dr. Moore that if the loss occurs after the eruption of the second permanent molar, the best procedure, in most cases, is to place a fixed bridge as soon as possible, and if delay should seem advisable, a space retainer should be used. The space retainer should also prevent the overeruption of the tooth in the opposing arch, and probably a plate would best fulfil all requirements. If the first permanent molar has been lost before the eruption of the second, a more difficult problem is presented. This problem may be prosthetic or orthodontic or both, and must first be considered by the general practitioner who first has the opportunity of seeing the great majority of these cases. The specialist seldom sees them until after the time for doing the greatest good has passed. The correction, which all orthodontists can accomplish, is but "a drop in a bucket" compared to the preventive orthodontia which the general practitioners might practice successfully here if only they did their best as early as possible. Pending the eruption of the second permanent molar, little can be done except to maintain the positions of the other erupted teeth; but at that time, a decision should be made between closing or opening the space previously occupied by the lost tooth. Certainly, the adjoining teeth must not be allowed to drift without supervision, for they usually require assistance one way or the other if malocclusion and facial deformity are to be avoided. Various things must be considered in making this decision. The difficulty of the proposed tooth movement under the two plans must be estimated, and in this, attention should be given to the distance the teeth would have to be moved, the character of the alveolar process and the amount of tipping or root inclination, it being easier, of course, to move the crown than the root, to improve the axis of the tooth for occlusal strain. Radiograms would, of course, help here. Orthodontic opinion seems to be against extensive bodily movement of molars, and probably, in most cases, greater good will result from prosthetic than from orthodontic treatment, though orthodontic assistance may often make possible better prosthetic work, as explained by Dr. Moore. Plate and spring appliances such as he has described seem particularly suited to these cases, combining as they do space retention and the means for improving tooth positions, preparatory to prosthetic restorations. It does not seem advisable nor is there time to discuss extensive orthodontic correction. That is often out of the question because of limitations of the patient's time or finances. It must be remembered, too, that ideal results are not to be expected by any plan of handling these cases; consequently, conservatism should be a controlling influence in efforts to give the patient the greatest benefits in a practical way.

COMMENTS ON THE CARNEGIE SURVEY OF DENTAL EDUCATION*

By ALFRED OWRE, A.B., D.M.D., M.D., C.M., F.A.C.D., Minneapolis, Minnesota

WHILE most of this audience has not yet had an opportunity to read in detail the full 600 page report of the Carnegie Survey of Dental Education in North America, we have had several earlier opportunities to familiarize ourselves with its tenor. In March, 1924, in a paper read before the American Association of Dental Schools,[1] Dr. Gies, head of the survey, stated clearly the features of the report that are of greatest interest to our body. In the nineteenth annual report of the Carnegie Foundation for the Advancement of Teaching, published in 1924, a section on the status of dental education clearly defines the attitude of the Foundation toward dentistry, past, present, and future; points out its weaknesses; cites its outstanding needs, and states clearly the general nature of its future recommendations. In the twentieth annual report of the Foundation, a section devoted to the study of dental education further develops these general questions, with a summary which clearly indicates the conclusions of especial interest to dental educators. We have had ample opportunity to reflect on this matter for the past two years. To bring freshly before us the part of the report essential to our present discussion, I may well read these conclusions.

Dentistry is an important mode of health service that is related directly to the teeth and closely adjacent oral tissues, and indirectly to other parts of the body and to the organism in general.

Dentistry should be made the full equivalent of an oral specialty of the practice of medicine in the quality and efficiency of its service to the patient.

The unusual mechanical and esthetic demands upon dentistry have, however, fully justified and continue to require its active development as a separately organized profession.

The long continued indifference of medicine to the abnormalities and diseases of the teeth and oral tissues suggests that, if dentistry were called stomatology and added to medicine, oral health service would continue to be neglected by the medical profession.

I may add parenthetically that this conclusion seems only too well borne out by the recent action of the American Medical Association in dissolving the section of stomatology on the death of the founder of the section, the late Dr. Eugene S. Talbot.

The success with which dentists have brought dentistry to its present state of usefulness and opportunity, in the face of social disparagement and professional belittlement, and the strength of the evolution plainly in progress, indicate unmistakably that the leadership of the dental profession will develop dentistry to its full possibilities in health service.

*Read before the Section on Dental Education at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

1. Gies, W. J.: Some Problems in Dental Education, J.A.D.A., 11: 1107 (Nov.) 1924.

Dentistry can be effectually and economically developed to the full service equivalence of an oral specialty of the practice of medicine through extension and improvement, in universities, of that system of dental education which, though separate from medical education, is closely related to it and should be more intimately associated with it.

This extension and improvement could be accomplished without requiring the prospective general practitioner of dentistry to become a doctor of medicine before beginning his dental training, and could best be brought about by pursuit of the following three main objectives: (a) the preliminary education and the instruction in the medical sciences should be the same in general scope and quality as for medicine; (b) the technical training, the applications of the medical sciences, and the correlations with clinical medicine should be sufficient to assure both ability to initiate safely a dependable general practice of dentistry and capacity to grow in proficiency; and (c) the most difficult phases of dental practice should be reserved for systematic graduate study.

These three objectives could be attained through the requirement of (a) at least two years of approved work in an accredited academic college, including several courses that would stimulate interest and develop ability in the prospective practice of dentistry, or reveal ineptitude, (b) and three years of intensive and well-integrated effort in an undergraduate dental curriculum for the training of general practitioners only, some or all of the years to be suitably lengthened wherever desirable to meet special local requirements; followed by (c) optional supplementary full-year graduate curricula for advanced training in all types of dental and oral specialization.

Such a reorganization would place physicians and dentists on the same plane of intellectual quality, and would give them analogous types of health-service education. It would develop similar degrees of medical comprehension, ensure mutual respect and understanding, and facilitate intimate cooperation in the promotion of the welfare of their patients.

This general improvement in dental education would require reconstruction of the dental curriculum, with special reference to important betterment of the teaching in all of its phases, economy of time without impairment of the efficiency of instruction in dental technology, more useful application of the medical sciences, and more advantageous correlation of clinical dentistry with clinical medicine.

The proposed regeneration of dental education would necessitate, in practically all of the dental schools, prompt increase in the number of teachers of the best type, great improvement of the libraries, and active advancement of research.

Lacking endowments, and in most cases being obliged to keep the quality of their work to the level of their income from fees, the dental schools in this country and in Canada will be unable to proceed with the suggested improvements unless, individually, they receive large gifts of funds for this purpose.

To this summary, I may add a quotation from Chapter X of the report itself on "Proposed General Reorganization" citing (a) the basis of the suggested reconstruction, and (b) the need for earnest attention to dental education in the universities. These, obviously, are the features of the report which concern us as educators, and which, as an educator speaking to educators, I shall attempt to discuss.

The main improvements in dental education that have been suggested by the findings of the present study would necessitate certain basic changes and extensions, which may be briefly indicated by this summary of five general conclusions:

(1) As an independent division of health service and, in effect, the oral specialty of the healing art, dentistry should receive, in universities, the quality of consideration and support now deservedly accorded to medicine.

(2) Teaching and research in the dental schools should be as effectual as the best in a university, and the status of dental teachers raised accordingly.

(3) The pre-professional education of practitioners of dentistry should be equivalent, in general character, to that of practitioners of medicine, which now includes at least two years of approved work in an accredited academic college after graduation from a four-year high school.

(4) The undergraduate curriculum in dentistry should be devised for intensive

preparation for the duties of general practice only, and should be so organized that the most earnest and competent students would be able to complete the training in three years.

(5) Full-year graduate curricula, separate or combined, including dispensary or hospital service as well as opportunity and encouragement in research, should be provided for all types of specialization in oral science and art, including those of private practice, public-health service, education and research.

Need for earnest attention to dental education in the universities.

Dental education cannot achieve its greatest degree of usefulness until the universities, accepting dental practice as an important mode of universal health service, give their dental schools adequate financial support, raise the quality of dental teaching to the high plane of excellence its responsibility requires, provide suitable library facilities for dental students, promote both graduate work and research in every aspect of stomatology, and set before dentistry the loftiest ideals of professional character and attainment. Notwithstanding the fact that three-fourths of the number of dental schools in the United States are parts of universities, the needs of dental education have been receiving only casual attention in most of them; and although only three of the forty-three continue to be proprietary, a larger number of the university dental schools are being conducted as commercial accessories. Misguided by the financial achievements of private owners of various schools before their absorption into universities, held in ignorance of the pressing needs of dental education by the inertia of dental faculties, and encouraged by the traditional view that dentistry is more trade than profession, which commercialism in dentistry continues to foster, various boards of trustees have assumed that a dental school may be acceptably conducted on a low educational plane at a high profit as a financial investment, for the university, although their medical schools are neither expected nor required to be even self-sustaining, and in some cases have been regularly financed in part with "earnings" from the operation of the dental schools. The condition in a number of these schools reflect unfavorably on the educational sincerity and on the capacity for public service of the respective universities.

While the title of my paper gives me nominal permission to discuss the entire report, it is obvious that anything so monumental, containing such a wealth of detail, could not be done justice in an address of the length prescribed by the circumstances. It is therefore without apology that I shall discuss mainly the educational phase.

I should like first to pay tribute to the report as a whole, and to congratulate our profession on its consequent improved outlook. We have got what we have needed, and what we in particular as educators have been seeking for the past twenty years. A more comprehensive, exhaustive and broadly interpretative study it is difficult to imagine. Every phase of dentistry has been investigated, analyzed and disinterestedly criticized.

Those of us who have from time to time supplied the Foundation with requisite information can testify that no detail has been overlooked. If we have been inclined to cavil now and then at the insistence of the Foundation on completeness and absolute accuracy, we are now, I fancy, ready to admit our childishness.

If the report, because of its entirely objective nature, hits us in a tender spot—and who has not at least one?—we should be sporting enough to master our grimaces and get back into the game. We are fully sensible that the Foundation is constructive, not destructive, in its aims, wholly impersonal, wholly concerned with the public welfare. And let us remind ourselves that it is, avowedly, to the same end that our dental schools exist. If, in some instances, we have to tear down before we can build up, let us do it cheerfully, with an equally disinterested aim. Let us

bear in mind, too, the ungrateful fact that dentistry, for all its achievements on the side of mechanical perfection, has lately had to face some staggering charges on the side of science.

Dr. William Hunter of London, you will remember, gave the strongest early impulse to such criticism. In a long article on "Oral Sepsis" published in 1910, he states, among other unpalatable truths:

> No one has probably had more reason than I have had to admire the sheer ingenuity and mechanical skill constantly displayed by the dental surgeon. And no one has had more reason to appreciate the ghastly tragedies of oral sepsis which his misplaced ingenuity so often carries in its train. Gold fillings, gold caps, gold bridges, gold crowns, fixed dentures, built in, on, and around diseased teeth, form a veritable mausoleum of gold over a mass of sepsis to which there is no parallel in the whole realm of medicine or surgery. The whole constitutes a perfect gold trap of sepsis of which the patient is proud and which no persuasion will induce him to part with. For has it not cost him much money, and has he not been proud to have his black roots elegantly covered in beaten gold, although no ingenuity in the world can incorporate the gold edge of the cap or crown with the underlying surfaces of the root beneath the edges of the gums? There is no rank of society free from the fatal effects on the health of this surgical malpractice.
>
> I speak from experience. The worst cases of anaemia, gastritis, colitis of all kinds and degrees, of obscure fever of unknown origin, or purpura, or nervous disturbances of all kinds ranging from mental depression up to actual lesions of the cord, of chronic rheumatic affections, of kidney disease are those which owe their origin to, or are gravely complicated by, the oral sepsis produced in private patients by these gold traps of sepsis. Time and again I have traced the very first onset of the whole trouble of which they complained to a period within a month or two of their insertion. The sepsis hereby produced is particularly severe and hurtful in its effects. For it is damned up in the bone and in the periosteum, and cannot be got rid of by any antiseptic measures which the patient or the doctor can carry out. Moreover, it is painless, and its septic effects therefore go on steadily accumulating in intensity without drawing attention to their seat of origin.
>
> Such are the fruits of this baneful so-called "conservative dentistry." The title would be a fitting one if the teeth were a series of ivory pegs planted in stone sockets. But the teeth being what they are—namely, highly developed pieces of bone tissue, possessing, I would point out, a richer blood-and-nerve-supply than any piece of tissue of the same size in the whole body—and planted in sockets of bone with the closest vascular relations to the bone and the soft tissues of the periosteum and the gums, the title that would best describe the dentistry here referred to would be that of "septic dentistry." Conservative it is, but only in one sense. It conserves the sepsis which it produces by the gold work it places over and around the teeth, by the satisfaction which it gives the patient, by the pride which the dentist responsible feels in his "high-class American" work, and by his inability or unwillingness to recognize the septic effects which it produces . . . .
>
> The medical ill-effects of this septic surgery are to be seen every day in those who are victims of this gilded dentistry—in their dirty-grey, sallow, pale, wax-like complexions, and in the chronic dyspepsias, intestinal disorders, ill-health anaemias, and nervous ("neurotic") complaints from which they suffer. In no class of patients and in no country are these, in my observation, more common than among Americans in America, the original home of this class of work.

This may well give us pause. And I could quote a dozen others as damning. I shall cite only two others which have especial reference to our problem: "The dental profession of today," writes Joseph H. Kaufmann,[2] "is menaced by a great danger, namely, *commercialized education*, which, imbedded in money greed, rotten with inefficiency, bankrupt in great teachers, steeped in self-appointed authorities, and lacking

2. Kaufmann, Joseph: J. Dent. Res., December, 1921, p. 392.

in examples of spiritual leadership, infects the hand that feeds it."

In 1919, Eugene S. Talbot, a sturdy pioneer in the educational struggle, wrote as follows:[3]

> It has been shown and accurately demonstrated that 95 per cent of all roots of teeth are imperfectly filled. In other words, owing to irritations in the process of treating and filling the roots of teeth or to the decomposition of tissue after filling, pathologic changes occur about the roots, as shown by the roentgen ray and the microscope. These pathologic changes have been known to the profession for the past eight or ten years, and yet the same methods of treatment are applied today as formerly. How long would the medical profession continue to perform an operation on any other tissue of the body, knowing that the technic was so faulty? My researches on animals during the past twelve years (Talbot, E. S.: Dent. Cosmos, May, 1919) show that the least irritation produced in the treatment of the roots of the teeth will cause absorption of the alveolar process and roots, with irritation and inflammation of the peridental membrane.
>
> Abnormal collateral arterial development in the roots of the teeth and the abnormal development of the granular layer of Tomes—researches of which have not yet been published—demonstrate the almost complete hopelessness of permanent success, no matter how well the root may have been filled.
>
> The number of focal infections and disturbances from faulty root fillings, local and systemic, is appalling. The average dentist, not being grounded in pathology, does not and cannot appreciate the seriousness of his faulty treatment. A different method of root filling must be immediately instituted or devitalized teeth must be extracted. A rule which I have adopted is that a patient's health is worth more than all the natural teeth.
>
> From time to time, in the past thirty years, I have repeatedly called the attention of the profession to the fact that modern dentistry is producing more disease than any other one cause. The profession is beginning to realize the truth of this statement. Since the first dental college was established, there has gradually developed a method of practice of mechanics regardless of pathologic results. The method of practice, at best, has benefited the individual patient only for the time being. On the other hand, after operations are performed, disease has followed in almost every instance.
>
> Our present method of treatment has not benefited the race as a whole. Decay of the teeth and deformities of the jaws have increased from generation to generation until at the present time hardly a child under 12 years of age can be found free from tooth decay and deformities of the teeth and the jaws. Since our present methods of procedure are faulty, we must resort to radical changes in treatment and devote our entire attention to preventive measures.

It was the recognition of too much truth in these charges, presumably, that led us to seek an impartial survey. The fact that it not only confirms but redoubles them is bound to prove even more ungrateful, but it is no fault of the survey. If we are candid, we must admit that the report, if anything, has dealt with us too gently. Our part is to rally under these discoveries and organize an attack on the evils of our profession. It is fortifying to realize that, in such a struggle, we shall have the further assistance of the Foundation. And we shall need it. Our path is beset with the snags of political wire-pulling, indifference, antiquated legal enactments, outworn traditions and threatened financial interests. It is bound to be an uphill fight, against powerful odds. If we are to win out in time, it will be by means of one weapon—*unity, solidarity*. It is highly regrettable that, in one important section, legal enactments should hamper the freedom of action of universities. This is a handicap that can be removed

3. Talbot, E. S.: Higher and Better Education of the Dental Student, J.A.M.A., 73: 805-807 (Sept. 13) 1919. (Chairman's address read before the Section on Stomatology of the American Medical Association.)

in time. The important thing now is unity of aim and, as far as possible, oneness of action. Something of our reward for such action is suggested by Bertrand Russell in *Modern Educational Theory*.

> Physical evil can, if we choose, be reduced to very small proportions. It would be possible, by organization and science, to feed and house the whole population of the world, not luxuriously, but sufficiently to prevent great suffering. It would be possible to prevent the increase of population from outrunning improvements in the food supply. The great terrors which have darkened the sub-conscious mind of the race, bringing cruelty, oppression, and war in their train, could be so much diminished as to be no longer important. All this is of such immeasurable value to human life that we dare not oppose the sort of education which will tend to bring it about. In such an education, applied science will have to be the chief ingredient. Without physics and physiology and psychology, we cannot build the new world.

Happily, many schools have already arranged for the first great step recommended by the report, the two years of preprofessional study which shall make this part of the education of dental students, "equivalent, in general character, to that of practitioners of medicine, which now includes at least two years of approved work in an accredited academic college after graduation from a four-year high school." Of the wisdom—in fact, the absolute necessity—of such a step, I believe there is now little serious question. Ever since Hunter's charges, in 1910, leaders in dental educational thought have appreciated the necessity for raising the standards of preliminary education, and—its natural concomitant—of improving the caliber of dental students.

In 1919, Dr. Talbot wrote:[4]

> Make a professional man out of the dentist, as well as a mechanic. Require the student to take one or two years' work in the arts and sciences. This will relieve the dean of the dental school of all responsibility of the preliminary requirements. The first two years of work in the dental school should be given up to didactic teaching. The student should not be permitted to operate on patients or perform mechanical laboratory work until the third year. All or nearly all of the last two years may be given up to the practical side of the specialty. The preliminary training in the laboratory of the academic and pre-medical courses will give the student all the finger training that is necessary to prepare him for his dental activities.

This is the view of a man whom we cannot afford to ignore. Twenty years before that, Dean Taft of the University of Michigan Dental School, writing in the *Ohio Journal of Dental Science*, said:

> The foundation branches of medicine should be studied by every dentist, but as to the best methods of doing this, there may be differences of opinion. Of course, every dental college should be organized so as to embrace all of these branches.

In 1920, J. P. Schneider[5] said, in a paper read before the Stearns-Benton County Medical Society of Minnesota:

> The dental teacher is aware—quite aware—of the gap that needs bridging between "most dentists," as some one has expressed it, "who are jewelers or metal workers; who fall down grievously in their duties regarding infection; who frequently discuss, but seldom practice, asepsis,"—between such men and the medically fully trained man whose adequate foundation work makes for biological reasoning as against mechanical. To my mind there is no hope of bridging the gap except we make dentistry a medical specialty,

4. Talbot, E. S.: Higher and Better Education of the Dental Student, Dent. Cosmos, 61:361 (May) 1919.

5. Schneider, J. P.: Journal-Lancet, 40:93 (Feb. 15) 1920.

with all of the usual prespecialty general medical training.

These are only a few of about forty statements of a similar tenor, made directly or implied by writers on dental or on medical education, which, in 1923, I brought together for a talk before our local dental society. If the Carnegie Survey has done nothing but bring about a uniform requirement of two years' preliminary scientific training this one accomplishment would more than justify the undertaking.

On the second recommendation, that the undergraduate curriculum in dentistry be made "three years of intensive and well-integrated effort—for the training of general practitioners only," there is less unanimity. Without the concomitant third recommendation of "optional supplementary full-year graduate curricula for advanced training in all types of dental and oral specialization," this recommended step might well be regarded as retrogressive. With it—considered, that is, as the two-three-graduate plan, which has recently been so much agitated—I believe that, for dental education as a whole, it is another great step forward, and the best concerted step we can hope for at present. Its acceptance now does not mean that there will be no progress. Rather it makes possible later steps which—all important consideration—can be taken by all dental schools, in a further concerted march forward. It is admittedly experimental. Prof. William Graham Sumner writes:[6]

> A great university can be subjected to experiments without any harm at all. It is a great mistake to think that an experiment, if it fails, will leave permanent evils behind. It will not do so. Every academic year stands by itself. Every year it is possible to begin anew, adopting a new plan or recurring to an old one, and no harm at all is done.

Most American dental schools are now, or are about to become, parts of "great universities." We may, therefore, go courageously ahead. I recently read, in a paper by an Englishman, Prof. Henry E. Armstrong,[7] several paragraphs dealing with medical education in England which seem to me to be directly applicable to our situation in dentistry:

> If we are prepared to admit—as I believe we must be—that we do not know what is the right plan to adopt, there is only one honest course open to us: to confess that such is the case, and at once set to work to experiment in order to develop a new system in fair accordance with our requirements. As yet we have done nothing but temporise and tinker; we must reconstruct the machine, not patch it. Unfortunately, the country is held back, not only by its indifference and failure through ignorance to appreciate the gravity of the situation, but also by a blind belief in the competency of those who conduct education.
>
> "The present is enough for common souls,
> Who, never looking forward, are in deed
> Mere clay, wherein the footprints of their age
> Are petrified for ever."—James Russell Lowell.

We forget that our teachers are not only brought up under false and narrow conditions, but also work under such; that his very office withdraws the teacher from the world, and makes it impossible for him to keep in touch with or even to understand its practical requirements, besides encouraging in him an overweening sense of self-confidence. Then it is characteristic of us that we never make rational trials to find out what is the right course to adopt: we believe in blundering into it, sooner or later, in some unforeseen manner. "Let others make experiments: we will reap the benefit of their experience," is too often our selfish attitude. The manu-

6. Sumner, W. G.: War and Other Essays (Our Colleges Before the Country), 1884.

7. Armstrong, H. E.: National Education: a Symposium on Science in Education—The Need of Practical Studies.

facturer declines to introduce a new machine, arguing that something better will soon be invented, and it will be as well to wait for that . . . .

Again, prejudice and vested interests prevail. And there is another section of the community in which the neglect of practical studies has specially serious consequences—the medical profession. Very rarely is any proper foundation laid at school for medical studies, and the position is rendered worse by the unscientific character of the preliminary medical studies, which can only be described as lesson learning run mad. The result is, very few medical men enjoy a scientific training; indeed their training is anti-scientific, and clinical practice alone affords them a chance of recovering their mental balance. Little wonder, therefore, that the general practitioner so often proves lacking in skill. Being in the condition described by Lowell's verse, medical men are not likely to cure themselves; indeed they have proved to demonstration that they are not even aware that they are victims of deep-seated disease.

The field of education, it must be admitted, is everywhere strewn with fossils, and as a rule none but fossil types serve as models. It were time that we followed the horticulturist's example, and by cross fertilization and careful cultivation sought to raise new and improved varieties. Surely our children demand this of us.

No moment should be lost in setting our educational house in order. We have not only to keep pace with others, but to make up for much lost time; and so much preliminary work has to be done before any effective progress can be made. An understanding must be arrived at as to what are the necessary studies for all, and how departures from the general course can be made to suit special cases. The teachers must be trained with utmost care. And as we need full freedom to develop a broad and liberal system, no extraneous authority must any longer be allowed to exercise a preponderating influence.

Louis B. Wilson, of the Mayo Foundation, gave a discussion, in 1925, before the Council of the American Medical Association on Medical Education, Medical Licensure, Public Health and Hospitals, relating to medical education which also bears very vitally on our problem. He said:

Dr. Ewing makes a very positive plea for graduate work as a necessary concomitant of undergraduate work. In this I wish to concur unqualifiedly. Is it not possible that this one thing, judged in the light of our experience of the last twenty-five years, might go a long way toward solving the problems of undergraduate work? Would it not be possible for the newly appointed Commission on Medical Education, for example, to make a careful survey of the things it is necessary that the general practitioner should know, since we all agree that it is the fundamental function of the undergraduate school to train general practitioners? Would it not be possible for us to come a little more clearly to our conceptions of what is necessary to be taught to the general practitioner and, complementary, to those things which are not necessary to be taught to the general practitioner? . . .

Is it not also possible that we might, if we had a graduate school, find an outlet for the cosmic urge of the eminent specialist to transmit his knowledge to future generations in the graduate school and let him hold off from the undergraduate student? Could we not utilize him to excellent advantage as a teacher of graduates where his instruction properly belongs and to some extent at least to bring the general practitioner into contact with the undergraduate student?

I think this experiment is going to work. When it was first proposed in my own school, a general protest arose. It couldn't be done—too little time was given each branch of dental technic already, etc. etc. When we got down to brass tacks, and reorganized what we had thought was already pretty well organized, we found that it *could* be done, and at a considerable gain of time and expense to the college, with no loss to the student. I believe the general house-cleaning necessitated by conformity to the two-three plan might result similarly in all our schools. Under this plan the graduate of the two-three course in the best dental

schools will be as well trained technically as he ever has been; and he will have a foundation of general science and a scientific point of view heretofore lacking in most dental graduates. He will be a much safer product to turn loose on the public, because he will recognize his own limitations, and he will not have wasted any time in getting a smattering of the specialties, such as orthodontia, which are properly of graduate grade. Moreover, with the optional graduate years, there will be a stimulus to the best students to pursue these specialties in schools fitted to do graduate work, under conditions suited to the pursuit of higher knowledge, yet with a firm technical foundation to build on. For the present, therefore, and as a step we can all take together, I regard it as an excellent arrangement. And I am not forgetting that higher goal of dentistry toward which I have been laboring for twenty years, the ultimate placing of dentistry on a par with recognized specialties in medicine. I said in 1922:[8]

> Ideally, dental education should branch off somewhere from the tree trunk of medical education, a tree which has for its roots preliminary training in mathematics, physics, biology, chemistry, a foreign language, and English composition. It should have the same relation to the parent stem as does the study of other regions, e. g., brain and nervous system, eye and ear, nose and throat, chest and heart, etc. The specialist in the oral-region should have the same standing as the specialist of any other region. His work is as essentially vital, involving vital tissue, and requiring thorough biological knowledge for its proper practice. This is the fundamental necessity—to train specialists in the mouth region, capable of diagnosing and prescribing for ills of the mouth. For the mechanical work involved in the care of the mouth it is possible to train men in much less time than is required for the oral specialist, and in much greater numbers. These men should work only under the direction of the oral specialist; and the latter should relegate the mechanical phases of oral treatment to the trained mechanic. It were as logical, to borrow an analogy from a noted scientist, to expect an eye specialist to make all glasses for which he writes prescriptions as to require an oral specialist to fill, clean, or otherwise mechanically treat all teeth his diagnosis finds faulty. This, briefly, is the hope for the future of dental education. How soon, and in what manner, this will come about depends largely on the findings of the Carnegie Survey of Dental Education, now in progress.

I have had no reason since to change this view. I only rejoice, with many others who held it, that it has begun to seem possible. Our requirement, of two years preprofessional work is a long step—an absolutely essential step—toward this working out. And there, for the present, we can afford to rest, for the reason that medical education, too, is in a state of upheaval. We have made a great advance in dental education as it is; and will gain in the end by waiting for medicine to settle down somewhat before planning our next campaign.

The eye specialist, the heart specialist, the mouth specialist and all the others must travel together a certain length of time—for two years of general scientific training at least. This, thanks to the survey, we have all achieved. Some of us have achieved more than this. Such institutions, enabled through endowments to experiment, can render dentistry as a whole an invaluable service. They may be in a position, when medical education has found its feet again, to demonstrate to medicine, heretofore not overanxious to adopt another child, that

8. Owre, Alfred: A View of Dental Education, Minneapolis Dist. Dent. J., September, 1922.

hereafter it cannot live without that child—that it must open its doors and its heart.

I stated a moment ago that medical education is now under fire, and that it behooves us to go a little slowly until it emerges. During the progress of the survey of dental education, Chancellor Capen of Buffalo University wrote the Foundation as follows:[9]

> Any reorganization of the curriculum of dental teaching which does not allow for what seem to me the inevitable changes in the medical curriculum is in danger of finding that it has taken over all the liabilities of a department of education which has grown up in a rather haphazard fashion.

Chancellor Capen also has a very illuminating article on the present status of medical education, called "Hindrances to University Action in Medical Education," in the *Proceedings of the Annual Congress on Medical Education, Medical Licensure and Hospitals*, for 1926.

In this article Dr. Capen sounds a second warning to us.

> Addressing this committee of the American Medical Association, he asks: I wonder if you are all aware how contagious has been your example? The medical profession has been perhaps the best organized professional body, and for the longest time. But other professional groups are now achieving comparable solidarity. Moreover, they are establishing educational councils in connection with their national association, on the model of the Council on Medical Education and Hospitals. The avowed object of these educational councils is to standardize and classify university schools for this or that profession, following the procedure of the American Medical Association. Thus standards for dental schools have been set up and dental schools classified. Standards for legal and prelegal education have been promulgated by the Council on Legal Education of the American Bar Association, and a classification impends. Standards for schools of pharmacy are in process of formulation. University schools for library training are now undergoing rigid inspection and classification on lines precisely similar to those followed by the American Medical Association. Standards for schools of home economics and veterinary medicine are being projected. In engineering circles there is at least discussion of the possibility that the great engineering societies should undertake to classify engineering schools.

Later on, Dr. Capen not only points out the necessity for changes in the medical curriculum, now so regulated and standardized by the American Medical Association that universities are powerless to experiment within it or to improve it, but also adduces the cheering fact that relief is in sight. He writes:

> And help is apparently forthcoming. The most promising undertaking in the whole field of professional education is the study of medical education which has just been launched by the joint action of the universities and certain educational foundations. The investigation is under the direction of a group in which all the interested parties are represented. It will take into account not merely the narrow technical demands of medical training but also the relations of medical training to other university activities and to the community at large. It is to be hoped that the results of this study will, in the first place, provide the basis for an extensive revision of the curriculum and, at the same time, will be so authoritative as to facilitate the modification or the repeal of restrictive laws and regulations.
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> Personally, I am enthusiastic about this investigation, not so much because I believe that it will unshackle medical education—important as that object is—as because it seems to establish a rational type of procedure for the determination of the content and the method of professional training. The lesson of our brief experience is that this determination should be a joint enterprise in which both the professional interests and the universities should be constantly and intimately associated. A great pedagogical problem is involved. A great social problem also.

9. Capen, S. P.: J. 26th Ann. Conf. Assn. Am. Universities, p. 75.

Now, therefore, it is peculiarly appropriate that the medical profession, having led us into the wilderness of external domination of professional education, should lead us out again.

Two years before this paper of Chancellor Capen's was read, he gave a short discussion before the American Association of Dental Schools in Chicago, of a paper by Dr. Gies,[10] all of which relates closely to this question of medicodental education. I shall read it.

I am one of those ignorant presidents. However, in the last year and a half I have tried to familiarize myself a bit with some of the problems of dental education.

I appreciate the courtesy of the chairman in allowing me to discuss an aspect of Dr. Gies' presentation that I think no one else has mentioned. Before coming to that point, I might say that this strikes me as a probable historic occasion. I have had long experience in attending educational conventions held by various associations, and I doubt if I have ever heard the problems of an educational group more lucidly and forcefully summed up, and the way to a large future more vigorously pointed, than they have been this afternoon by Dr. Gies. Obviously, your future lies in the closest possible cooperation with the medical profession, but, obviously, that is not going to be the simplest thing to bring about. You may be willing to do it—I do not know whether you are; but the medical profession will still take some persuasion. I think this is one of the things that you must square yourselves to right away. The logic of the situation is absolutely irresistible. Now, if you can once break through the traditional reserve of the medical profession in this particular and let them see for a few moments what the type of education Dr. Gies has prescribed really means to them as well as to you, the barriers will dissolve almost overnight. I say that with perfect conviction because, in Buffalo University, we have just gone through with that experience.

The point I rose to speak of particularly is the preprofessional curriculum and the preprofessional curriculum itself. I wonder if you realize the fix the medical profession has gotten into in the matter of the curriculum. The medical curriculum is so tied down by state and other regulations that the medical schools cannot move in any direction. I was in Omaha last week attending the convention of the American Association of Medical Colleges, and three days were devoted almost exclusively to the question as to how they could get some movement in the ice-jam of their curriculum. They have taken steps that are promising. But the point is, further, that you haven't any of that freezing process as yet to contend with, or at least only to a very slight degree. You are not dictated to as yet by your council on education with respect to what you may do; you are not tied up with respect to the actual items in your curriculum by state laws, as is the medical profession. The medical faculties recognize two defects in their curriculum that have worried them very much. One is that the so-called preclinical subjects all come in the first two years and that the application of the knowledge gained in those courses is separated almost by a wall from the theoretical aspects of the subjects. Medical faculties would like to see some interlocking of the two. It is almost impossible to bring that about. Experiments are being tried looking toward accomplishing it, but it is one of the serious problems.

The other point is that they have innumerable specialties scattered through the course here and there, not in large enough amounts to accomplish the purpose of training specialists, but in sufficient quantity to clutter up the medical curriculum and interfere with the proper presentation of the more important subjects.

If you could attack the entire problem represented by the dental curriculum, including the preprofessional end of it, and say we need this and this and this to train the dentist, rejecting that which is not needed, you would solve these questions by dentistry. I think you should say to yourselves: we do not care anything about the order that the medical school has adopted; we will find a better order if one is available; we will not necessarily choose the topics the medical men have taken, but we will adjust the curriculum to the job. If you will do that, I have no doubt that the economies in time which Dr. Gies has outlined are entirely feasible. On

10. Gies, W. J.: Dental Educational Problem, J.A.D.A.,11:97 (Nov.) 1924.

the other hand, I think you have an opportunity to make one of the really important contributions to American professional education, which will react also to the benefit of medicine. The larger things cannot be done without money, and I should like heartily to second the remarks which Dr. Gies himself made and which the last speaker emphasized. The universities must recognize this dental problem and be willing to invest in its solution, and your Association can help them do it. I think, however, that when the report presented by Dr. Gies is published, it will be the one convincing piece of evidence to university administrators that this is necessary.

I believe that we are largely agreed with this conclusion. I hope we are ready to cooperate to the extent of our several abilities.

It is a stimulating thought that our efforts will have not only a local, nor a national, but even an international influence. Medical and dental education in England are both in a state of flux. English dental students are now required to register in the manner and under the conditions required for medical students. They pursue practically the same scientific studies as medical students; and in a medical school.

An examination of this curriculum, as Dr. George Newman points out makes clear the principles of sound dental education:[11]

> First, it is to be founded on science. The elements of science are relegated to the Secondary School, though applied chemistry and physics are included in the four years' course. The fundamental medical subjects, intermediate and clinical, are included, but they are bent to a special purpose, and this purpose is afforded a setting in biology and comparative anatomy and physiology. Secondly, emphasis is laid upon the necessity of furnishing the student with a thorough and comprehensive technic of his art—mechanics, metallurgy and operative work. Dental mechanics are now to be taught in the dental hospital, and if any such instruction be taken in pupilage with a registered dentist the time to be devoted to it must be at least twice that required for the corresponding instruction in a prescribed dental school. Though apprenticeship is retained, two years of such experience may only be counted as one of the necessary four years of professional study. In a word, the practical work required, hitherto of a miscellaneous nature, is brought under direct supervision and within the equipment of a recognized dental school and the discipline and inspiration of competent teachers. Lastly, the new curriculum makes dentistry the true handmaid of Medicine, a scientific specialism of Medicine and not merely a craft. The new knowledge of bacteriology and infection, anesthesia, antiseptic surgery, venereal disease, and principles of pathology, and the methods of radiology, are all brought fully into application. Dentistry may now become, for the first time, an organized instrument and means of Preventive Medicine.
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> There can be little doubt of the result of these reforms. They place the dental profession on a new basis; the Register has been extended and now includes 13,000 names; the unregistered dentist is debarred from practice and incompetent workmanship is reduced; the registered dentist is protected in the exercise of his profession under an authorized Dental Board; and the dental student may obtain a sound and comprehensive education.

Our efforts, if wisely directed, may dovetail into the British reorganization; they may affect the whole English-speaking race, and its dependencies. The state of English professional education is well indicated by an extract from the concluding chapter of the book from which I have just quoted,[11] by Sir George Newman, chief medical officer of the ministry of health and of the board of education.

> Whilst the present memorandum has set out briefly the profound changes which are taking place in Medical Education, it has had regard to that wider setting which alone gives it proportion. The training of the

11. Newman, George: Recent Advances in Medical Education in England. (A memorandum addressed to the minister of health.)

physician is no longer a narrow engagement; it affects the well-being of the State, in both public and private practice. The community is concerned as taxpayer and as patient; and the practitioner's field is the world of men and affairs. For, though his reach is a long one, he exerts his influence from the home and the bedside, the trusted confidant of his patient. On this ground his education and his function must be individualistic. He must be so trained as to become a practical, well-educated and fully equipped medical man, enabled to reach the top of his own particular capacity, alert, ready, with an expanding and forward-looking mind, which shall be the dexterous and willing instrument of science and craft and progress, whatsoever be its endeavor or its destination. We have already seen that whilst the new medical curriculum recommended by the General Medical Council—and indeed the Public Health *Rules* also—gives added emphasis to the application of science to the clinical aspects of medical education, the inspiration of reform has been the prevention of disease. The spirit of research and of prevention has

"forthwith touch'd
The whole enormous matter into life."

Obviously curative medicine and remedial surgery must have immediate priority, but the ultimate goal is prevention. It is not the event of death which we can escape, but the incidence of avoidable invalidity and premature death. It is the enlargement of life and the increase of human capacity, physical and mental which we seek to ensure. In this great enterprise the primary desideratum is the education of the student, an education in the appreciation of man and his needs, in the knowledge and pursuit of Science, and in skill in craft. "Let us emancipate the student," wrote Sir William Stokes, sixty years ago, "and give him time and opportunity for the cultivation of his mind, so that in his pupilage he shall not be a puppet in the hands of others, but rather a self-relying and reflective being. Let us ever foster the general education in preference to the special training, not ignoring the latter, but seeing that it be not thrust upon a mind uncultivated. Let us strive to encourage every means of large and liberal education in the true sense of the term." . . .

The oppressive load of the examination system calls for reconsideration by the Examining Bodies. At present, in spite of the reasonableness, high competency and goodwill of the Examiners, the system remains a shackle upon medical education. So heavy has the student's burden become that he is driven to standardize his effort, in degree and kind, by the prescription of the Examining Body—not the love of learning, not what he requires for life, not even his technical skill and experience, but what will answer the questions on the day of examination is the student's criterion. Inevitably the occasion is subject to chance, superficiality, brevity and hazard. Yet in Medicine at least it should be sure and certain, and the unready and incompetent candidate should be rejected. There seems to be a general consensus of opinion in all the Medical Schools that what is required is an examination which shall be reasonably uniform, which shall follow and not lead the education provided, which shall be severely practical and clinical as well as theoretical, and which shall include a record of the work done by the student and how it was done.

The Scandinavian countries too, except Denmark, are practically on the same basis. When the survey shall have covered Europe and the Asiatic countries, the movement in which we are engaged will have assumed soul-stirring proportions.

The other "basic and organic changes and extensions in dental education" indicated by the survey as necessary in the suggested reconstruction are, if possible, more vital to its future and the proposed changes in the curriculum. They are, you may remember, (1) that "dentistry should receive, in universities, the quality of consideration and support . . . now accorded to medicine;" and (2) that "teaching and research in the dental schools should be as effectual as the best in a university, and the status of dental schools raised accordingly."

The fallacy of expecting a medical school to be self-supporting—still worse, to contribute to the support of

other schools or colleges in the university—has long been recognized. Now that dentistry's rightful position as a specialty in health service is recognized, to exact either self support, or, much less, a contribution to university funds, of a dental school is equally fallacious. Though it will doubtless remain for a long time to come an "independent division of health service," as Dr. Gies describes it, it is, nevertheless, "the oral specialty of the healing art." It is more exacting, perhaps, than any other specialty, and requires at least equivalent support. That the Carnagie Foundation is urging this principle on the universities is of the greatest possible significance to dental education, and a reason for the greatest rejoicing.

No less significant and gratifying is the insistence on oral research, and, concomitantly, the training of qualified teachers. I can add nothing to Dr. Hunter's vivid presentation of the need for oral research, except the testimony, which could doubtless be duplicated by everyone present, that I see daily in the clinic painful evidence of its absolute truth. No field of research vitally affecting the public health has been heretofore so scandalously neglected. If dentistry is to function fully as a division of health service, such research is obviously a fundamental necessity And I need not emphasize to this body the shocking need for scientifically minded, and scientifically and pedagogically trained, teachers. We are all too familiar with the impossibility of finding such men in sufficient numbers—almost, of finding them at all. The Foundation can receive nothing but the most cordial support from us in its effort to stimulate and to increase oral research. Educated, competent teachers, obviously, will be the now less valuable byproduct.

> Worthy research requires a prepared mind, experience, leisure, imagination, learning, and high technic. It is not for the inexperienced undergraduate with other tasks on hand. But there is here, nevertheless, something vital for him, which has hitherto been gravely neglected in our national schemes of Medical Education, and that is to learn to love research, to know its methods, to be moved by its spirit, to appreciate its stupendous achievements, to recognize that in it and in it alone can the future be secured. This is what we have neglected to teach him. It has been explained to him that all knowledge comes by scientific investigation and research, clinical as well as other. Moreover, the teacher who is not imbued with the spirit of research is unable wisely to teach, and thus it comes about that an inspired teacher and a seeing student are the two desiderata. (Newman.)[11]

As Dr. F. C. Waite writes in his pamphlet on the "Progress of Dental Education:"

> At the present time we are in the midst of the most active period of progress in the entire history of this field of education. The publication in 1925[12] of the report on the Study of Dental Education made during the past four years under the auspices of the Carnegie Foundation for the Advancement of Teaching will make that year an epochal year in Dental education, equal to 1840, 1884, 1893, 1908-9 and 1917. There can be no doubt that progress will continue. The next few years will see in dental education great advancement and a probable stabilization, and a decade hence, better than now, can be written a judicial appreciation of the results of the activities in the past 10 years.

As it is stated in the report of the Carnegie Foundation last year:

> The success with which dentists have brought dentistry to its present state of usefulness and opportunity, in the face of social disparagement and professional belittlement, and the strength of the evolution plainly in

12. Publication has been delayed, owing to the unexpected magnitude of the task. 1926 will mark its completion.

progress, indicate unmistakably that the leadership of the dental profession will develop dentistry to its full possibilities in health service.

As dental educators, we have the greatest responsibility for bringing to pass this rosy prophecy. "Let us," then, as Emerson urges in "The Conduct of Life," "make our education brave and preventive. Politics is an after-work, a poor patching. We are always a little late. The evil is done, the law is passed, and we begin the up-hill agitation for repeal of that of which we ought to have prevented the enacting. We shall one day learn to supercede politics by education. What we call our root-and-branch reforms of slavery, war, gambling, intemperance, is only medicating the symptoms. We must begin higher up, namely, in Education."

The first clearly perceived step in the right direction is unified action in adopting and perfecting the two-three-graduate plan. Here and there, an institution that is extraordinarily endowed, or otherwise exceptionally able to do so, may experiment in a wider field and blaze the path for the others. The mass of us shall have to proceed more slowly. If we do this bravely, we may find ourselves some day in the master class Emerson defines: "The measure of a master," he writes, "is his success in bringing all men round to his opinion twenty years later."

DISCUSSION

Albert L. Midgley, Providence, R. I.: To have listened to this excellent presentation of a subject so vitally related to the public welfare and the promotion of dentistry is a rare privilege. Dr. Owre has so clearly analyzed and effectively emphasized the salient points in the conclusions of the study and survey of dental education that to attempt to add to them would be simply useless repetition, and so, I shall confine what I have to say to two or three features of his paper. In effect, his treatise is an urgent plea for a unified effort of all good influences and all earnest men, to place dentistry on a strictly professional basis in the art of healing. It is his conviction that, eventually, dentistry will or should become a recognized specialty of medicine. Whether it is destined to occupy this position, the future alone will tell. Plainly, at the present time, it should function as an independent division of health service. In commenting on the statements of authorities quoted by Dr. Owre, I have in mind his allusion to our "tender spots." Some of the indictments drawn against dentistry generally, while true in many respects, are misleading; for they leave the reader with a distorted notion of the practical values of high grade dentistry. Some of them appear to have been inflamed with academic emotion. Is it not fair to assume that they reflect an unaccountable misunderstanding of the quality of the activities of first class dentists in their interpretation of the underlying biologic principles involved in various procedures? One statement especially is decidedly overdrawn, " . . . form a mausoleum of gold over a mass of sepsis to which there is no parallel in the whole realm of medicine and surgery . . . the worst cases of anemia, gastric conditions, colitis of all kinds and degrees, and obscure fevers of unknown origin, or nervous disturbances of all kinds ranging from, etc. . . . Time and again, I have traced the very first onset of the trouble of which they complained to a period within a month or two of their insertion." If the scheme of medical education is sound and well balanced, why this statement from medicine as late as 1910? Why the vision at that time with medicine for many years richly endowed, promoting research and possessing capable, inspired teachers? The fundamentals in medicine are well taught and physicians treated serious conditions related to the teeth long before 1839. This belated observation and announcement as late as 1910 does not appear to be in harmony with medicine's attainments in other directions. A casual observer realizes that the biologic aspects of dentistry's procedures have been neglected or lost sight of; the mechanical and esthetic phases have been widely developed, and dentistry, stunted through commercialism,

lacking endowment and the interest funds create, has been left to shift for itself. Allusions to the shortcomings and deficiencies of dentistry will serve no useful purpose at this time except as they may arouse those in authority to action. In fairness to the builders of dentistry, past and present, we must admit that their accomplishments have been unusual. While the statements referred to are true in some respects, they are tempered with emotions, superlatives and distortions, and at this time appear to have a questionable value. It is well for us to remember that conditions due to poor dentistry are in a large measure the results of the indifferent, half-hearted attitude of medicine toward dentistry in the solution of its problems. Let us adjourn this discussion of dentistry's deficiencies until someone tells the whole truth, and, in the meanwhile, study the causes of these results and place the blame where it belongs, in those universities with medical and dental schools where there never has been and is not now a cordial, cooperative effort in the medicodental relationship. I heartily agree with the essayist that the two-three graduate plan is another great step forward and the best advance yet offered for meeting present conditions. The two-three graduate plan does not necessarily imply a two-four basis eventually. It is generally felt that its superiority in competition with the two-four plan will be clearly demonstrated in the very near future; for specialization in practice is not taken care of under the two-four plan. Some of us fail to realize the importance and influences of the graduate features of the two-three graduate plan, and we overlook the economic values of an intensive undergraduate program; for, in the history of dental education, not one school has ever functioned on an undergraduate program of economic soundness, and most graduate courses have had a doubtful value. It appears evident to many that, with well integrated courses and constant sustained application, so essential in the development of skill, it will be possible to develop a safe general practitioner in a three-year professional course with pet schemes, irrelevancies and duplications eliminated. In my opinion, Dr. Owre is ultraconservative and cautious when he states that the graduates of the two-three graduate course in the best dental schools will be as well trained technically as they ever have been. I feel certain that they will be better trained because, with a broader cultural foundation and a more comprehensive knowledge of the sciences, the students will grasp principles more quickly and apply their teachings more readily, and so develop true skill and all it implies, i. e., practical facility in doing one's work. Let us support in unity, both in spirit and in action, the findings of the survey and cease to think in terms of our own schools in evaluating the worth of the two-three-graduate plan. Let us heed the warning of Dr. Capen that we may not inherit the liabilities of a system of professional education that has not proved wholly satisfactory. Let us make haste slowly and await the results of an investigation now under way, which Dr. Capen says is "to establish a rational type of procedure for the determination of content and method of professional training." In our deliberations, let us have in mind at all times Cardinal Newman's oft-quoted statement "That which is theoretically ideal is not always attainable practically." Speculation and conjecture have their places in life's activities. Room for such practices in the development of health service through dentistry has narrow confines. In the discussion of this interesting essay, it is appropriate for me to allude in an appreciative way to Dr. Gies and his great work. I have had exceptional opportunities through close association to reflect on his findings and writings and take this occasion to state publicly that I agree with all his conclusions.

A UNIVERSITY CURRICULUM FOR GRADUATE ORTHODONTICS*

By GUY S. MILLBERRY, D.D.S., San Francisco, California

ONE cannot approach this assignment without giving a momentary thought to the preparation necessary for graduate work in orthodontics. The science and art in this special field of dental endeavor seem to have developed progressively along two definite lines, biologically, and in the physical sciences. Interest and enthusiasm have been the exciting factors, as in all other human endeavor.

Such being the tendency, it seems appropriate to recommend to, or require of, prospective students who expect to practice orthodontics, a knowledge of these sciences; therefore, zoology, chemistry and physics should be specified in the preparation curriculum.

One may reasonably presume that the high school student does not know, at his age, just what vocation he expects to follow; hence, he cannot be well advised. Educational experience shows that most students follow a suggested program in the expectation that the career which follows it may some time fall to his lot, and vocational guidance in many of our schools strengthens the tendency to prepare for some particular thing in life.

Any field of professional endeavor, except, perhaps, music and letters, profits by a knowledge of these sciences, which are interwoven into all forms of human activity and those pursuits which we are concerned with should exact more knowledge of them. Thus, college training during the undergraduate years should include the opportunity for further study. I use the word "opportunity" advisedly; for education, especially the higher forms, should be looked on as an opportunity.

Graduate work in any well established educational institution is based upon suitable preparation, even in some instances the requirements for a given major subject being specifically and quantitatively stated.

In the so-called medical sciences, anatomy, with its concomitant subjects, embryology and histology, physiology and biochemistry, and pathology are essential to the study of orthodontics, and a reasonably good knowledge of them should be had. In addition, such dental subjects as dental anatomy, dental histology and dental pathology must be studied. If such knowledge is basic to all forms of dental practice, there is no reason why it should not be taught to all students alike. The debatable question seems to be the extent and character of such instruction.

Some writers contend that schools or colleges of orthodontics should be designed and conducted for the exclusive

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

use of such students. I am not in accord with such views because all educational tendencies in the realms of medicine, of which this is merely a division, point toward a unification or consolidation of teaching facilities and personnel, for sound economic reasons.

Every dentist should know something of orthodontic science, and it becomes necessary to introduce the irreducible minimum of undergraduate instruction in the regular dental course. Another valid reason for offering it is that students who desire to engage in practice of the specialty will be partially prepared for graduate study later on.

Theoretically, each student should possess a reasonable knowledge of the known factors in the etiology of malocclusion and of the biologic and physical factors involved in the treatment of it, and, technically, he should have some training in the value and method of making models and taking impressions scientifically and constructing the simpler types of appliances used in treatment. Some teachers advocate the inclusion of such instruction in operative or prosthetic technic courses by their instructors. Would they be as willing to have their type of instruction given by an orthodontist? One might as well expect to succeed in training a skilled protozoologist in a botanical laboratory because both are in the field of biologic science.

We now approach the theme of this essay. May I skeletonize it? Orthodontics is the most independent specialty in dentistry. The tendency in practice is (1) to prevent malocclusion by acquiring a better knowledge of the etiologic factors and combating them early (the biologic phase), and (2) to correct malocclusion in cases which are beyond the stage of prevention (the physical science phase).

Students who take up the study of orthodontics are of two types: (1) the recent graduate whose interest has developed keenly under various stimuli during his college residence, and (2) the older practitioner who, for one of many reasons, may choose to follow it.

The former is more plastic and is easily guided in this advanced field. He is more adaptable. A change of environment does not materially alter his progress. He accepts the suggestions favoring the prevention of malocclusion and, unless he is fond of technics, will, in the end, be a more desirable practitioner as far as the public is concerned. The latter has many adjustments to make. He often forfeits a practice and an income, and, if he has engaged in simpler types of orthodontic practice, may have developed prejudices favorable or unfavorable. His reading and study have probably been confined to casework. He has not studied basic science profitably, as a rule, and his mind is somewhat unelastic. His inclination will usually be toward corrective work, and, for the present, he should be encouraged to follow it as a graduate student, if his ideals are worthy.

In the curriculum in a graduate school of orthodontics, the major subject can be divided into different courses, each given by a teacher of professional grade, whose particular ability, justifies the assignment. Thus, etiology, diagnosis and prognosis, orthodontic practice, advanced orthodontic technic, the history of orthodontics and orthodontic nomenclature suggest themselves as descriptive titles for courses in this major subject.

The important part of graduate work in orthodontics lies in the ancillary subjects in the curriculum, and in research; for herein lies the opportunity for a regeneration of the science. As previously stated, two broad fields are open in biologic and physical sciences. Students interested in biology should be encouraged to take advanced work in physiology, embryology, orteology, histology and anatomy, all of which offer splendid opportunities for preventive service.

With suitable preparation, such students should be eligible to register in courses in the medical school in related clinical subjects such as rhinology, otology and laryngology. This plan presumes, as any graduate plan should, that all the ancillary courses shall be taken in departments of the university other than dentistry unless, for very special reasons, a particular course can be given by a capable instructor in the dental school.

Those interested in the physical sciences will find mathematics, physics, advanced chemistry, metallurgy and roentgenology particularly alluring as ancillaries, and with equal potentiality. Their contact with their instructors will tend to disseminate a wider knowledge of orthodontics in all of these fields, of value alike to the laymen and to the profession.

A few graduate students may choose to teach. They should include upper division or graduate courses in education, philosophy and psychology in their program, as well as one or the other of the above suggested subjects.

If the material reward is the beacon which attracts the student to orthodontic practice, there is no justification in his taking a graduate course except to hasten the period of a larger income. Therefore, each graduate student should be encouraged to contribute something to science, and this opens the question of research.

Obviously, every man cannot be expected to be productive in research. On the other hand, one never knows where the spark of genius lies, so some problem requiring intellectual effort and investigation should be assigned to each graduate student. The subjects may not all be of major importance and may not be worthy of a master's degree; yet their investigation may result in distinctive accomplishment at the time or later in life. The field of investigation in orthodontics is very broad, and any results which will reduce the percentage of deformed faces and malocclusions of the teeth will be a blessing to the children of the world.

On request, the chairman of this section submitted to our school a number of subjects for investigation, among them the following: the development of the palatine vault; the mandibular angle; facial growth; a photostatic investigation; a gnathostatic investigation of increasing facial length. Some of his suggestions are now being carried out in the department. The field of anthropology and biometry offer most interesting opportunities for this specialty.

As to clinical instruction under this graduate plan, the student has a reasonable opportunity to take on as many cases as his capacity will permit, provided his work is well balanced. No student should be permitted to engage solely in clinical study if he has regular status.

When different methods of treating cases are taught by various members of

the staff, the graduate student has the opportunity of receiving such instruction from these sources. He not only learns the various methods of treating such cases but he is also in a position to handle the ambulatory cases in which migration is over a great distance, without hazard to the child or professional discourtesy to his colleagues.

We have tried this plan in the University of California and are satisfied that it offers to faculty and student body alike a transitory solution of the question of orthodontic instruction.

Those students who are interested elect to take the advanced courses; the others receive only what we believe to be the irreducible minimum for all dentists. While we may not give credence to all proposals, we at least give heed, and we introduce every possible factor that will add to the purpose for which we exist. Methods of teaching always have varied and always will vary in every institution and should do so.

Orthodontic practice is not widely appreciated by the public, especially in the rural districts. Usually, cases are presented when it is too late to prevent or treat them correctly. The dental profession is responsible for this, and, through them, the fault lies with the schools. The older practitioners were told to defer orthodontic treatment until after the age of puberty. Our children pay the price.

At present, nothing except his conscience prevents any licensed dentist from engaging in the practice of orthodontics. Let us hope that our dental schools and associations will make every effort to correct this condition soon, for the sake of the children.

DENTAL SERVICE IN THE COMBAT ZONE*

By C. FRANKLIN MacDONALD, D.D.S., New York City

THE paramount mission of the medical department is officially laid down as (1) the preservation of the strength of the forces in the field, and (2) the care and treatment of the sick and injured at the front, in the communications zone, and in the zone of the interior.

Dental service conforms just as strictly to these rules, and, as in the medical or surgical fields, the closer one works toward the front or actual firing line, the more the service rendered will become of an emergency character, with the primary object of keeping men fit and on the line, first, last and always.

Dental work in the front line, or wherever the conditions require that everyone as far as possible keep under cover for protection, is obviously limited to the relief of pain, with extraction about the only operative procedure.

The combat zone comprises more territory than the actual front line, and large parts of it are relatively protected except from shellfire and bombing. Officially, the combat zone is designated

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as that portion of the theater of operations occupied by front line divisions, corps and armies.

In all combat zones, even terrain which has been fought over and devastated, there will be found sheltered spots where the field dental equipment can be set up, and, where, if time permits, much real constructive dental work can be carried on. Badly devastated areas offer some problems with regard to finding proper shelters. In warm weather, a tent or any sort of shelter which affords reasonable protection from rain is quite sufficient. The dental chair can always be placed at the tent door or at the opening to the improvised shelter so that good operating light is provided. In cold weather, with the usual stormy days and overcast skies, the problem of light becomes of serious import. Windows with glass in them in badly shot up areas are objects of curiosity. During winter weather, the "dental office" must be kept warm enough to work in; otherwise, it is useless, and this means a room, hut or tent which is kept more or less closed. If I may be allowed to cite my own personal experience in this line during the World War, possibly the situation may be made clearer. I was assigned as dental surgeon to the 11th Engineers, a regiment which was attached and served with both the British and the American forces, most of the time in the combat zone. November, 1917, found me with two companies in the old Somme area, about a mile and a half from the front line. We were occupying some old huts made of reclaimed corrugated tin sections and one so-called elephant iron hut. The medical detachment had taken over one of the huts which served as the medical corps sleeping quarters, dispensary, hospital and my dental office. The weather was now very raw and chilly, with many days of either rain or overcast skies. It was necessary to keep the doors and windows of the hut closed and often to run a stove for warmth. The windows consisted of square openings cut through the tin sides over which were stretched a sort of linen material. Originally, the linen was probably white, but at this time it was a dirty yellowish-brown. With bright sunlight, one could operate at these windows, but rainy or overcast days made it an almost impossible procedure.

I realized at once that winter weather out in such an area was going to present a serious problem if any dental work worthy of the name was to be done. The captain of one of the companies had carried with him for more than four months a white shirt, which he was persuaded to donate for my experiment. The tail of this I nailed securely to a wooden frame the size of the hut window, with the material tightly stretched. The cloth was then soaked with light oil. This window pane gave better transmission of light than the old and heavier cloth, but it was not really adequate on rainy days or days heavily overcast. After ten days' search, a British dump was found where the officer in charge finally got for me a piece of real glass, about 18 by 24 inches. One of the company carpenters made me a heavy frame into which the glass was securely placed. The hole in the hut side was enlarged; the glass frame set in place; the crevices along the side were stuffed with old burlap, and the dental office was able to carry on even on dark days. This frame with glass I carried with me until I was de-

tached from the regiment, in December, 1918, a matter of over a year, and it was used many times, particularly during the cold weather, and proved of great value.

Recently, the question of light for dental offices in the field has been seriously taken up by the Army, and I understand that now they are getting out a sort of nonbreakable glass-like material—pyalin, I believe it is called—which will be part of the dental field equipment.

Light and shelter often offer a problem to the dentists in the combat zone, and he must be prepared to use his ingenuity in overcoming such obstacles to carrying on dental work. After all, dental equipment is useless unless some place is found where it can be set up and the work carried on. May I also suggest, in passing, that the dental enlisted assistant is an important item in the combat zone. A dental officer will do well to make a careful selection of such a man. The right type and temperament will prove of incalculable value under many difficult situations. A man who can find a wooden flooring when wood is not available, who can get a heating apparatus when stoves are not procurable, who can get coal or wood when such is not to be had, etc., is a gem. The wise dental officer also is he who asks no questions.

As to actual dental work, a great deal of constructive dental work can be done and ought to be done in the combat zone. Amalgam, cement and gutta-percha fillings can be placed, teeth can be cleaned and gums treated. As a general rule, teeth with exposed pulps or abscessed conditions should be extracted. Root canal treatments or root fillings should rarely be attempted. Fractures of the jaws from whatever cause should never be treated by the ordinary dental officer in the combat zone. Temporary wiring, splinting or bandaging is all that is necessary. The patient should be promptly evacuated to a proper unit equipped to care for such conditions.

The fact that dental work is being done under adverse or difficult conditions is no excuse for poor dental work. Work may proceed more slowly and equipment may not be ideal, but decay can be completely removed, cavity margins carefully prepared, fillings well placed and properly dressed down so that there are no overhanging margins, contour and occlusion made correct, and a general finish produced worthy of inspection. For my own part, I can truthfully say that, out in the field, I placed large amalgam fillings, contoured and fairly well carved, and at no time was I ever blessed with a complete field equipment. In many of these cases, when I was with a company over a reasonable period of time, these fillings were even polished.

In the combat zone, a great deal depends on the capacity of the individual dental officer as to what is accomplished. He will often be thrown on his own resources and he will be obliged to work out problems as they are presented. Work in the combat zone should be in the hands of men of some years of professional experience.

Recent graduates or those of only a few years of actual dental practice would be better assigned if sent to the base hospitals, concentration and training camps, etc., where they can be associated with other dental men in infirmaries. In the field, where conditions are not favorable and equipment

often incomplete, the man of experience is needed, one who can get along with little, has confidence, skill, speed and sound judgment, the result of practice. While it probably is against military procedure, men whose experience and skill have qualified them for the rank of major or lieutenant colonel should be sent out with troops in the field, while young lieutenants and captains, in many cases, would give much better service back in camps and hospitals under jurisdiction of older, experienced men. This does not hold so true of dental men attached to a division where the dental service will be more or less of a constant unit under a directing head. With troops such as engineering, signal corps, aviation and artillery, that are often sent out as individual and quite independent regiments, battalions or companies, the dental officer assigned should certainly be a man of experience because here he may be absolutely and entirely on his own responsibility and remote from any direction or assistance.

The acute infection of the gingivae which has come to be commonly known as trench mouth appears in the combat zone, as well as in other zones, and should be promptly and properly handled by the dentist with the men.

Trench mouth (Vincent's infection), in its worst and most extensive phases, does tend to incapacitate a man for efficient work. When acute and extensive, involving, as it may, the gingivae of both the upper and lower jaws, the patient has a feeling of malaise and lassitude and lacks appetite; the tenderness of the gums makes eating a difficult task; constipation may exist, and, in general, while not sick enough to go to bed, he is not good for full duty. I have never seen a condition of trench mouth which, in my opinion, demanded evacuation to a hospital and which did not respond rapidly when proper treatment was applied.

Vincent's infection of the gingivae produces a mechanical situation rather different from Vincent's angina. The infection seems to start in some pocket, as a pocket formed by a gum flap about the distal surface of the last molar teeth, upper or lower, more often the lower molars. Another common site of origin seems to be along the lingual gingival line, on the lingual aspect of the interproximal space of the upper central incisors. The infection at once attacks and invades the gingival tissue of the interproximal spaces, penetrating well down between the teeth.

This particular invasion and infiltration into the tissues forming the interproximal papillae should determine the method of treatment. Anything which helps to cover over or seal up the interproximal space is contraindicated. Such applications as silver nitrate or phenol are in this class because they produce an eschar or act as a coagulant, which tends to retain the infection in these spaces. In fact, any local application of medicine, while it helps to ease pain and reduce somewhat the acuteness of the infection, fails to get to the seat of the trouble.

A mechanical situation such as the interproximal space requires a mechanical method of treatment. The mechanical treatment is to scale and clean these spaces and all the tooth surfaces by means of suitable instruments and appliances.

The first thing to be done in trench mouth is to clean the tooth surfaces mechanically, particularly the surfaces forming the interproximal spaces which

are invaded. Medication is a secondary consideration.

Scaling and cleaning the teeth under these conditions is a bloody and painful operation, but the discomfort is more than compensated for by the tremendous change which takes place in less than twenty-four hours.

Following is, concisely, the procedure for handling trench mouth in the field, including the instructions given the patient for his own care of the condition and for the protection of his fellow soldiers.

The mouth is rinsed out with any mild antiseptic. Potassium permanganate is available in any medical field chest and is particularly good.

The teeth surfaces are scaled with such instruments as are available, carefully, yet with reasonable thoroughness, the operator going particularly into the interproximal spaces. The operation is painful and bloody, and, at this time, can obviously not be done with complete thoroughness.

The tooth surfaces are polished, especially at the gum line, with an orangewood stick and pumice.

Floss silk, doubled and impregnated with pumice, is passed through the interproximal spaces carefully, polishing the tooth surfaces. Next to the scaling, this application of the floss silk is the most important part of the whole treatment and should not be passed by.

The mouth is now thoroughly rinsed out and the gums are touched with iodin. The foregoing will produce results. With my own cases, unless they were particularly extensive, I carried out one more, what may seem rather radical procedure, provided I had a dental engine. A small brush was set up in the holder for straight and right angle. The patient was told to hold on to the side of the chair and, with the brush carrying pumice turning quite rapidly, it was run lightly over the tooth surfaces at the gum edge and into the interproximal spaces. Even with care, this is brutal enough because the gum surface is bound to be and should be slightly brushed. This produces a copious flow of blood and leaves behind a fresh bleeding surface.

The gum surfaces are now touched with fresh tincture of iodin and the mouth rinsed out thoroughly.

Instructions to the patient are almost as important as the scaling operation. It must be impressed on him that, if he expects to get over this disease, he must keep his teeth and gums clean, and he should be shown how to do it. After going through the above-described procedure, he will be anxious to cooperate.

His toothbrush, by now, must be thoroughly infected. It should be washed and then boiled for five minutes. The boiling, even under difficult field conditions, can usually be done, and should be insisted on. The brush now is soft and should be used in this condition for the next few days. Later, if possible, the man can get a new toothbrush, but he can carry on with the boiled one.

He should be asked, for the next few days, to cut his smoking about one-half, or more if he can. To tell a soldier to stop smoking is like trying to keep the sun from rising, but most of them will cooperate on the fifty-fifty proposition and many will voluntarily cut even more for a few days. A ban on smoking greatly assists in the rapid clearing up of this disease. I have heard patients say that the smoking of some particular brand of cigaret has brought on

trench mouth. This I do not believe, but I am convinced that the hot irritating tobacco smoke is an important factor in keeping up the acute condition.

The patient should be informed that his condition is infectious and can be transmitted to his comrades, and therefore he must use all precautions not to pass it on. His mess kit and eating tools must be washed separately, in hot water, with soap powder. In the combat zone, water and fuel may be and usually are, difficult to get; so the use of separate wash water may be impossible. Under these conditions, the patient must be the last one to wash his mess kit. If other men have trench mouth or if there seems any possibility that the infection is spreading, the mess orderly should be informed and the mess sergeant told to boil the dish water and use soap powder in it, if possible. At roll call, the men may be instructed to report at once to the dental officer if their gums suddenly become sore and tender and bleed easily. If it is necessary to give a patient light duty for a day or so, obviously he should not be assigned to kitchen duty.

If a patient is constipated, a proper cathartic should be administered.

As to medication, which is important but should follow and not precede the scaling operation: In the combat zone, some medical supplies are not easily obtained, and probably it will be necessary to make use of such supplies as will be found in all medical field chests. Arsphenamin, neoarsphenamin, chromic acid, methylene blue, sodium perborate, etc., even hydrogen peroxid, ordinarily will not be found in a field chest. Potassium permanganate is supplied, but it has to be put in solution, and, ordinarily, could not be dispensed to the men for them to use by themselves. Potassium chlorate in 5 grain tablets, which is supplied, offers an excellent medication for trench mouth. In fact, it is so efficient that I still employ it in private practice. It is used in the following manner: A tablet is placed in the patient's mouth, and he is instructed to dissolve it slowly with the saliva. As the tablet dissolves, the saliva is pumped around and between the teeth, and the excess saliva containing the potassium chlorate is swallowed. Ordinarily, this process consumes from five to ten minutes. Three 5 grain tablets are dispensed for the first day, to be used morning, noon and night, after the teeth are brushed and cleaned. If the condition is bad, three tablets are dispensed for the next two days, and, for the following two days, two tablets, to be used morning and night. This makes a total of 15 grains a day for three days, and 10 grains a day for two days; certainly not an excessive dose. In mild cases, the three tablets can be used the first day, and, for the other days, the dose can be cut down to two, or even to one for a few days.

Tablets of this sort are easily dispensed in the field, and the ordinary soldier, by reason of the simplicity of the medication, is able to treat himself.

When possible, the men should be seen the next day after the scaling operation. At this time, cotton is rolled into elongated wisps of sufficient thickness to go, with a little binding, through the interproximal spaces which have been attacked. The wisps are soaked in iodin, passed between the teeth and pulled through the interproximal space. This treatment, when properly done, may be slightly painful because the cotton acts as a swab, mechanically sweep-

ing away sloughing gum tissue and producing fresh bleeding surfaces. Other portions of the gum tissue as on the buccal, labial and lingual aspects, may be swabbed with cotton and iodin in the usual way. The extraction of broken down or diseased teeth or roots and the filling of carious teeth should be carried out as soon as the acute condition has been controlled.

From this point on, continued treatment may necessarily be left to the judgment of the dentist and according to such field conditions as are present. To effect an approximation of a complete cure, these cases must be checked up at frequent intervals, with as careful and thorough tooth surface scaling and polishing as is possible in the field. It is very difficult to eradicate this disease, especially when considerable of the interproximal gum tissue has been lost. The initial treatment often performs such wonders that, at first glance, it would seem that the disease was ended. In too many cases, this may prove to be, in actuality, a delusion. While the original severe condition may not return, there will be favorable spots where the disease will crop out again and again, if not followed up.

Severe attacks of this gum infection seem to do almost irreparable damage to the gingival tissues, especially the tissue in the interproximal spaces, leaving behind a condition which makes the gingival tissues prone to reinfections on slight provocation or carelessness in mouth hygiene on the part of the patient.

From the initial site of infection, this disease spreads with amazing rapidity. For this reason, as soon as any portion of the gingival tissues shows evidence of this type of infection, scaling and cleaning should at once be instituted and no time wasted with local applications of medicaments in the hope that this rather easy and speedy treatment will stop the condition.

It is obvious that little in the way of rules for procedures can be laid down for the officer called on to do dental work in the combat zone. He will, for the most part, be obliged to formulate his own methods. As situations change, he must be able to change with them, adopting himself to new and, many times, unpleasant conditions. No matter how difficult the situations seem to be, dental officers who have the will and the desire to do so, will find that they can accomplish much in their small sphere of duty, toward sustaining the health, comfort and efficiency of the fighting men.

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A PHASE OF EXODONTIA*

By C. R. GRISSINGER, D.D.S., Pittsburgh, Pennsylvania

THE word "exodontia" originated with George B. Winter, of St. Louis, and was accepted by the dental profession to cover the work in dentistry coming under the extraction of teeth. It was the desire of Dr. Winter, when writing the book on exodontia, published in 1913, to give to the profession a word that would raise the standard and character of this work, eliminating the various descriptions and usages of promiscuous terms pertaining to this specialty. Exodontia, then, is the science of the extraction of teeth, in all of its particular phases.

It is most unfortunate that the schools of dentistry give so little attention, by way of instruction and personal application, to this science, as the future prestige of the individual dentist going into practice depends on his skill, and inability to advise regarding or execute intelligently and successfully the extraction of a single tooth will reflect on his standing.

Most of the horror regarding dental service that has left its indelible impression on the minds of the human subjects for generations has come as a result of inability to remove teeth intelligently and skilfully. Consequently, because of crude methods employed, extraction has been looked on as merely a mechanical act, accompanied by fear, pain and distress.

There is a need of men properly qualified to execute the scientific work required in the extraction of diseased teeth, the condition of which is occasioned by neglect, by employment of commercially minded dentistry, by abnormal development, by caries and other dental diseases, attended by a lowered resistance of the human body.

It is the opinion of the best educators in dentistry that men of the profession should not engage in specialties until after they have had sufficient experience in general practice to understand all phases of dentistry, so that they may have the highest regard for the character of the work already done on the teeth. They should have actually performed dentistry requiring thoughtful and skilful effort, in order that they can appreciate the significance of breaking down or destroying such work. Without this experience, there is marked danger of radical mistakes being made in diagnosis and recommendations.

Five years has been laid down by some as a minimum of time to spend in the practice of dentistry before entering a specialty. It is my opinion that a longer time should be spent by way of this preparation, and the technic and details should be obtained in postgrad-

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uate work and the experience secured in the conduct of general practice, rather than experimental work on the patients of reference. In other words, the preparation should be such that, when men enter this field, they will indeed be exodontists, able to render skilful, intelligent service, prompted by judgment that will uphold the good name of the profession and prevent needless suffering to humanity.

The exodontist should have a thorough knowledge of the anatomy of the heart, joints and osseous structure, particularly of the mandible and maxilla, and of the physiology and histology of these parts. He should have a general knowledge of bacteriology, which will enable him to recognize types of infection of the human body, and particularly a knowledge of bacteria, which plays an important part in dental diseases. He should have a thorough knowledge of pathology, and particularly the diseases of the head and the mouth. He should have a comprehensive knowledge of physics, and the basic principles of leverage, in order that he may know how properly to apply force in the execution of his operations.

Exodontia is in a field by itself, without having oral surgery attached to it. If one engages in this specialty and will practice it skilfully, he will have all he can do without digressing in the field of oral surgery. If both are practiced, one or the other is generally neglected.

SURGERY

The basic principles of general surgery should be mastered, so that, when surgery is applied to this particular field, it can be executed in harmony with the best thought of the day. I cannot stress too greatly the necessity of handling carefully the tissues of the mouth, so that proper incising of the soft tissues and excising of the bone may be accomplished with the least amount of trauma. It is unnecessary to bruise or lacerate the mouth in exodontia. Application of instruments should be properly made, and the technic carefully executed, avoiding unnecessary injury. It must be kept in mind that most of the injury and accidents occurring in the execution of these procedures are the result of improperly applied force and a lack of knowledge of the part to be operated on.

I have reason to believe that the extraction of teeth has been the most abused operation in dentistry. The first need of dentistry was the extraction of teeth, and ever since the first tooth was removed, there has been some one willing to undertake the operation, or at least attempt it. There are men still connected with the dental profession who, notwithstanding their unfamiliarity with advanced technic of extraction, will take a chance. If they fail, they will leave the work unfinished, or send the patient to a specialist; thereby complicating the operation.

Exodontia is beyond the experimental stages, and its technical operative procedures are standardized. It should be the practice of the exodontist to make a radiogram of the tooth or teeth on which he is to operate. A careful diagnosis should be made in each case, the pathologic conditions, probable resistance and possible complications that may be present being noted. He should then operate, keeping in mind the preservation of the soft tissues and the septum of the adjoining teeth that are to remain; the prevention of pain to

the patient; the removal of all roots and tips of roots with their accompanying infected areas, and the removal of all spiculae of bone and sharp points of the alveolus, so that the margins are smooth and rounded and will not remain to irritate the soft overlying tissue. He should also remove all protruding and overhanging ridges. The case should be observed until the patient's condition is favorable for further constructive dentistry.

PHYSICAL DIAGNOSIS

Ample time should be given to examination of the mouth, pharynx, lungs and heart, as well as a general examination of the patient. Too much importance cannot be laid on a proper and timely physical diagnosis. It is well to obtain all the history possible in connection with the case. The greatest tact must be exercised in order not to excite the curiosity of the patient unduly, and arouse fear. Experience in analyzing patients enables one to avoid unnecessary questioning. Recourse should be made to taking the blood pressure and to urinalysis, if the exigencies of the case demand.

ANESTHESIA

The exodontist should have a comprehensive knowledge of anesthesia, both general and local. In dentistry, we have two of the safest anesthetics that can be administered to the human body, nitrous oxid-oxygen, as a general anesthetic, and procain as a local anesthetic. There is no need for other anesthetics in the routine practice of exodontia. Dentists should have a better knowledge of the greatest possibilities of these anesthetics. They should know how to administer them; they should understand their action and effect, and also, where each is indicated.

NITROUS OXID-OXYGEN

Nitrous oxid-oxygen is blamed for many of the fatalities that have occurred in the dental office, a most unjust attitude. I am disposed to question whether nitrous oxid-oxygen, in properly applied exodontia, has ever been solely responsible for a fatality. It can be a contributing factor, in shock and certain cardiac conditions. It is my judgment that this is the safest anesthetic, if properly and intelligently administered. My personal experience, covering a period of twenty-five years, and more than 125,000 administrations, an average of from 5,000 to 6,000 a year, has proved to me that, with care, intelligent diagnosis and careful administration, there are few individuals in which it is contraindicated. E. J. McKesson, of Toledo, Ohio, says: "Nitrous oxid does not destroy tissue as do other anesthetics." My observation supports this belief. It is my opinion, after using both nitrous oxid-oxygen and procain extensively, that the former is the anesthetic of choice in exodontia. This has been verified by statistics and data obtained by Dr. McKesson, in which he found that the largest percentage of men practicing exodontia in this country use nitrous oxid-oxygen.

All operations in exodontia, including impactions, can be satisfactorily performed under this anesthetic. There is no need to be hurried, and everything desired can be accomplished. Patients should never be kept under any anesthetic longer than is absolutely necessary, and the operative technic should be executed with precision.

PROCAIN

Procain infiltration and conduction anesthesia is the best local anesthesia for the practice of exodontia. Care must be exercised in the administration, and a full knowledge of the tissue and systemic effect should be had. Fatalities have occurred with this anesthetic in dentistry, but I am inclined to the opinion that the anesthetic is not at fault so much as improper diagnosis and judgment in its application. The psychic effect of the operation in the use of a local anesthetic is its greatest hindrance.

Procain is not an old anesthetic. Its toxicity depends on the rate at which it enters the circulation. It leaves the circulation and is destroyed in the liver. Epinephrin diminishes the toxicity, even by intravenous injection; probably by cardiac stimulation. Renal irritation is not uncommon after local use, but it usually disappears after a few days. These facts do not seem to be generally understood by physicians and dentists. Procain does have a tissue effect.

Men of our profession should be well informed as regards both these anesthetics, and should be able to face men of the medical profession without hesitation and discuss intelligently their use when indicated. Physicians, on the whole, know little about anesthetics, and especially do they know little about nitrous oxid-oxygen and procain, and their effect on the system.

We should be proud of these two anesthetics, as they have been largely developed by the dental profession, who administer them to more patients than do medical men, even in hospital practice.

ETHICS

The position that the specialist occupies in observing ethics should be kept in mind: (1) toward the patient; (2) toward the dentist or physician referring the case, and (3) the exodontist's own position in the case. The patient should always be the first consideration, and his rights and protection should supercede all other matters bearing on the case. The dentist or physician referring the patient should be given the next consideration; his position should always be honored and respected. Should disagreement arise relative to the course to be followed with the patient, consultation should be had with the dentist or physician, and if still further disagreement results, the exodontist should refuse to handle the case. At no time should the patient be permitted to lose respect or confidence in professional references, no matter how wrong the judgment of the one referring the case may be. Information should always be obtained of those having professional interest in the particular case, so that under no circumstances can a question be raised in the patient's mind as to the correct course to follow. The exodontist's position is peculiar, as he must answer to the patient and the dentist referring the case or cases. He must have every possible point covered so he can clear himself if necessary, and be fair-minded in all dealings with the professions and the patient.

A properly conducted exodontist's practice requires an organization especially trained, if the best results are to be obtained; so it is necessary to be an organizer, or have some one connected with the organization who will take this responsibility on himself. Every detail must be considered if a smoothly running organization is to be the result. In proportion as these details are covered, litigation, confusion, misunder-

standing and constant disturbance will be avoided. Judgment naturally comes as a result of experience, and the greatest consideration must be exercised in handling every case that comes to the exodontist's attention.

The office should be exceptionally clean, for extracting offices have had the reputation of being dirty. There should be a reception room that is attractive and bright, dispelling any gloom that might be, and usually is, in the mind of the patient coming into the office. The working part of the office should consist of the least number of employes. I prefer well-trained female assistants. The following are indispensable in the conduct of my work: a specially selected graduate nurse anesthetist, with her assistant; a roentgen-ray technician, and a secretary and executive.

The patients are divided into three classes: (1) those who can be operated on at once, and who are generally well; (2) those who will require some form of premedication; such as the nervous, highly stimulated or alcoholic types, who may be operated on at once; (3)impaction cases and full-mouth extractions, in which patients will require some form of premedication, and are usually operated on by previously arranged appointment. In the former class of work, correctly made radiograms are necessary, and a careful study should be made of the radiographic findings before the operation is planned.

The routine practice is as follows: The patient, who usually has an appointment, is admitted to the reception room, where he is immediately interviewed by the secretary. The name, address and reference are taken, when he is requested to be seated. A record card for all data is taken from the file, running in consecutive number, and a day slip with the secretary's notations is attached. The roentgen-ray chair being vacant, the patient is placed thereon. The technician notes the teeth, roentgenographs the case and, at the first opportunity, informs the anesthetist, who makes her examination and, if necessary, consults with the operator. The anesthetist is trained to secure all information possible of the physical condition of the patient, such as history of past and present conditions, blood pressure and other examinations in keeping with the work of an anesthetist. No unusual conditions or complications being indicated, the case is ready for operation. The patient is taken to the operating room, the films having been developed and studied and all previous information checked, and a card marked with the teeth to be extracted, and the operation is performed. On recovery from the anesthetic, the patient is taken to the retiring room and required to remain from twenty minutes to a half hour, or longer if necessary. He is then interviewed by the secretary, and an instruction slip is given him on the care of the mouth. Every patient is requested to return two days after operation for observation, and when dismissed, is always instructed to return if any trouble should develop. In the event the patient does not return for this observation, a letter is written, reminding him of his failure to keep his appointment, and again requesting him to report for observation. This letter is written in order that the patient's postoperative condition can be studied, and, in the event the patient does not return or leave a message regarding his condition, he has no redress.

All of this requires work in detail, but it avoids many annoyances. From twenty-five to fifty patients can be handled nicely in this way by a single operator during the day, with most satisfactory results to all concerned.

RETROSPECTION

The object sought for in the presentation of this phase of exodontia in the limited time allotted me is to call attention to some of the things that seem to be overlooked in the practice of this specialty. Exodontia is a science that requires considerable time in preparation by the dentist having an ambition to take up the specialty. He should have more than merely a liking for the work. The thought that prompts most men to enter this field is the hope of larger financial returns than are found in general practice. While this is true with some, it is not the case with all who find themselves thus engaged. It is difficult work and has many angles to it. Unless time has been spent in preparation, it will present even greater difficulties and bring grief to both operator and patient.

It is the duty of the exodontist to aid in maintaining the ethics of the profession above reproach, and on an equality with those purposes that command the highest respect of the public for intelligence, culture and scientific attainment. Remember that all the benefits enjoyed today in connection with the profession have been developed by the efforts of those who were actuated to strive for higher ideals.

CHRONIC INFECTIONS OF THE MOUTH AND OF THE TEETH AND THE TISSUES INVESTING THEM*

By THOMAS B. HARTZELL, M.D., D.M.D., F.A.C.D., Minneapolis, Minnesota

WE are here considering chronic mouth infections, concerning which the profession of dentistry is most interested, and for the care of which the dentist should be, and is, most responsible, i.e., infections of the teeth and the gums and of the supporting or investing bony tissues that contain the teeth. This at once eliminates, to a great extent, certain lines of bacteriologic investigation. It further eliminates the bacteriology of those diseases already thoroughly well known, namely, tuberculosis and syphilis. It also eliminates the bacteriology of such diseases as scarlet fever, which, being acute in nature, does not fall within the purview of this paper.

It is a recognized fact that the oral cavity can be the habitat of many different types of bacteria, some of pathogenic nature, and some of nonpathogenic character. My own first effort to eliminate from this problem the nonpathogenic bacteria growing in the mouth was to collect, in as great a quantity as possible, everything growing in and about the teeth, in tooth scrap-

*Read before the Section on Bacteriology, Pathology and Diagnosis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

ings, decayed dentin, and pus exuded from pyorrhea pockets, and, on culture, subsequently to administer it to animals; in some instances, to inject the whole mass of material thus gathered, and then study those bacteria that survived and produced diseases in the animal.

Of the chronicity of the diseases that break down tooth structure and also destroy the supporting tissues around teeth, there can be no doubt. We all know that the disintegration of tooth structure itself and its supporting tissues is, as a rule, a matter of years, not days. Therefore, it would seem that material thus collected, particularly that material collected from the invaded tissue surrounding the teeth, should contain the active bacteria creating the disease present in them, and in the event that it supports its own life and reproduces in the tissues of the animal to which it is administered, and in the further event that the lesions thus created in the animal tissues resemble the lesions found in the human tissues at the place where the material is obtained, it would seem reasonable to conclude that the bacteria thus regained are chiefly responsible for the conditions produced under ordinary circumstances, in and about the human teeth.

The observations here recorded have been the result of work done by a group of individuals during the last dozen years. I am greatly indebted to W. P. Larson, Arthur T. Henrici and E. T. Bell, who have all been interested in, and associated to some degree in, research intended to bring out and clarify the relationship of the bacteria responsible for chronic mouth infections. Larson has been at work constantly with the view of ascertaining the fundamental laws governing and controlling bacterial actions.

Collection of all types of bacteria found about teeth and the introduction of that combined material into the circulation of animals resulted in the recovery in the animal lesions thus produced of the streptococcus only, except in comparatively rare instances, in which the staphylococcus reappeared and made itself evident by acute infection in the tissues of the animals.

The streptococcus, on the other hand, we found scattered through the tissues of the bodies of our animals, producing in the area where found pathologic changes that were observed to be of certain characteristic type and regularity. This fact led Henrici to undertake a consistent investigation of the streptococcus alone but with many different strains and using in all the series the total of 225 animals, ninety-two of which were given hemolytic streptococci, and the remainder, non-hemolytic streptococci.

The pathologic reaction in the several tissues of the body resulting from the introduction of these bacteria into the bodies of the animal was, within certain limits, of the same character, i.e., the multiplication of bacteria in the field where they lodged resulted in calling from the blood stream in considerable numbers, plasma cells and lymphocytes and comparatively few polymorphonuclear leukocytes. As growth went on, the tissue invaded lost its characteristic cellular outline and eventually was transposed into fibrous tissue.

A study of the pathology induced in periodontoclasia, more often called pyorrhea alveolaris, reveals that the tissues surrounding the teeth, which we know to be more often invaded by

streptococci than any other tissues of the body because of the great mass of streptococci always in the gingival crevice, show this same reaction, destruction of the cells of the parts and replacement of them by fibrous or scar tissue.

Observation and study of the lesions produced experimentally with streptococci in the heart and kidney reveal relatively the same conditions. I here draw your attention to pictures of lesions reproduced from various experiments, notably those on heart tissue, showing first the inflammatory change; second, the development of Aschoff-Geipel bodies, third the formation of scar tissue. In the kidney, from the work of Bell and me in the production of chronic interstitial nephritis, I submit the picture of well-formed crescentic scar tissue involving what was formerly normal glomerulus, the crescentic mass of scar tissue and eventually the complete destruction of the glomerulus from the introduction of streptococci into the blood stream of a monkey, leading finally to the complete change of the glomerulus into scar tissue.

Llewllyn and Jones, speaking of inflammatory changes in striated muscle tissue, state that:

> When the attack is more severe and of longer duration, the existence of anatomic changes is very evident. Well-marked signs of muscular inflammation are present, such as hyperemia, hemorrhage, serous exudation into the interstitial connective tissue (perimysium interum), and softening, discoloration and disintegration of muscular fibers.
>
> Moreover, it is interesting to note that, in more advanced cases, not only marked atrophy of the affected muscles, but also inflammatory proliferation of their interstitial fibrous tissues, ensue, which culminates in the formation of so-called rheumatic modules.[1]

We may therefore say that the chronic inflammatory reactions resulting in the tissues surrounding teeth are those of the streptococcus because of the tissue changes and the resultant creation of fibrous and scar tissue to take the place of the normal tissue lost as the result of the inflammatory activity. Its activity in peridental tissues is, to a greater or less extent, modified by the presence of the organisms of which the staphylococcus is the most important, not because of any marked power of invasion, but because of its universal presence and because of its great power to produce powerful solvent ferments, enabling it to break down tissue from the surface. It is a camp follower of the army of invading streptococci and is the organism responsible for the active pus flow from the gingival crevice.

The fusiform bacillus and its spirochete, which is its degenerating form, produced from the bacillus under favorable conditions of growth, as shown by Larson and Barron,[2] are never found deep in the tissues in the ordinary case of peridental infection because, in the chronic inflammations, they live on the surface of dead or dying tissue. Only under exceptional conditions of growth does it become an active invader after the manner of the streptococcus; which is the reason that the topical applications of creosote iodin compound or chromic acid so benefit phagedenic pericementitis or trench mouth.

The studies by Kligler and Gies,[3] of

1. Llewellyn and Jones: Fibrositis, Comparative Morbid Anatomy, p. 100.

2. Larson, W. P. and Barron: J. Infect. Dis., 13: 429, 1913.

3. Kligler and Gies: J. Allied Soc., 10: 282, 1915.

the bacteria growing on tooth surfaces showed that, roughly speaking, about 70 per cent of the bacteria growing on tooth surfaces belong to the pyogenic family, approximately 50 per cent of them being streptococci and 20 per cent, staphylococci. We would be justified, from the work of these two men alone, in concluding that the principal pathologic changes in the tissues surrounding the teeth are due to their presence.

My own experience in the examination of thousands of specimens of bacteria taken from tooth sides, above the gingival line and below the gingival surface, confirms the observations of Kligler and Gies. The work of Henrici, both alone and with me, also confirms their observations as to the number and constant presence of these pyogenic cocci.

Henrici's experiment in which he took cultures from the tissues of two or three teeth removed from the site of the bacterial focus, in the human mouth, and his findings of bacteria in the tissues of the teeth, two or three teeth removed from such focus, even though the tissue externally betrayed none of the signs of inflammation, still further confirms the view that these cocci are chiefly concerned in the chronic infections about teeth.

A consideration of my own sections of human gum tissue revealing streptococci distributed through them,[4] combined with the fact that, in normal, healthy gingival tissues, where the mucous membrane is firmly attached in the bottom of the gingival crevice, and the tissue hard, pink and firm, no tissue bacteria are revealed by culture, nor can they be found in the sections, still further confirms this view; namely, that the chronic inflammatory reactions observed about human teeth depend on the bacteria constantly present in the tissues, and if we accept the concept that the most advanced invader, I mean the germ deepest in the tissue, is responsible for the disease, then we must conclude that the streptococcus is the principal factor in all chronic infections not only of the investing tissues of the teeth, but also of the teeth themselves, because the mass of accumulated observations prove it to be true.

We may therefore reasonably conclude that as far as chronic lesions about and in the investing tissues of the teeth are concerned, the streptococcus is the organism responsible for the disease, because (1) it is always present in greatest numbers; (2) it is the most invasive and penetrating organism observed, being the only bacterium found in the tissue in advance of the macroscopic lesion; (3) it can be seen in stained sections of tissue well beyond the ulcerating surface of the gingival crevice; (4) it can be secured by culture two or three teeth distant from a focus, and (5) its presence in animal tissue is followed by a definite sequence of events, whether the tissue invaded is heart muscle, striated voluntary muscle, the glomerulus of a kidney or the peridental tissue, i.e., peridental membrane and bone. The sequence of events is as follows: invasion; inflammatory reaction; immigration of plasma cells and numbers of mononuclear leukocytes, and serus exudate destruction of tissue and replacement of it to a large degree by fibrous connective tissue. The staphylococcus is not an essential factor in these events. They can occur with-

4. Hartzell, T. B.: Etiology of Pyorrhea Alveolaris, with a Simplified Treatment, J.A.D.A., 12: 1452 (Dec.) 1925.

out its presence, as is certainly the case in invasion of heart, of voluntary muscle or of the glomerulus of the kidney in chronic interstitial nephritis.

Regarding the pulps of teeth, we are compelled to the belief that the streptococcus is again the principal pathogenic invader. It is the bacterium *per se* that is most frequently found in the pulps of vital teeth whose surrounding tissues are diseased. Examination of the pulps of a hundred vital teeth[5] and histologic examination of the series of pulps by Henrici and me show that the pathologic changes in these pulps are produced by the streptococcus. Sieberth was early impressed in his studies of pulpitis, with the fact that he found the streptococcus in unexposed and dead pulps.

That the streptococcus is also the principal and advance invader in the process of caries of dentin has been repeatedly testified by many observers, among the most notable of whom are Kantoriwitz,[6] Goadby,[7] Black and Henrici. The method followed by these authors, particularly Kantoriwitz and Goadby, have been to excavate all decalcified dentin, cauterize, excavate again and culture from the material removed from the tubules in the undecalcified region. These cultures invariably produce streptococci. Whether or not the streptococcus is the principal bacterial element in opening the enamel remains yet to be proved.

Gies and Klinger[2] show that it is the predominent bacterium growing on the surfaces of all teeth, comprising nearly 50 per cent of the total bulk of such growth. Black demonstrated it in the bacterial film and mentioned it particularly in his nineteenth lecture on operative dentistry. Many other authors have testified to this same fact.

In view of this accumulated evidence, we are compelled to believe that the most important bacterial factor in chronic diseases of tooth pulps, dentin and the surrounding investing tissues of teeth is the streptococcus, and that the other bacteria of importance in the diseases of these tissues play a comparatively small part in the disease processes, and that, for practical purposes in treatment, the study of the pneumococcus, of the fusiform bacillus and the accidental visitants of oral tissues has thus far yielded practically nothing.

That we may eventually control the growth of the streptococcus through vaccination is a hope that we may reasonably be justified in by the recent work of Larson in his soap scarlet fever streptococcus toxin immunity. He has successfully checked the spread of scarlet fever in six epidemics during the past year, by introducing scarlet fever streptococcus combined with sodium ricinoleate directly into the blood stream of exposed individuals, thereby producing immunity to scarlet fever streptococci in from four to six days. Favorable reports have been received to date from about 20,000 cases. If immunity can be produced to and with the scarlet fever streptococcus, it seems reasonable to believe that we are on the threshold of the control of *Streptococcus viridans* also.

5. Henrici, A. T., and Hartzell, T. B.: J. Allied Soc.

6. Kantoriwitz: Deutsch. Zahnheilk., 21.

7. Goadby, Kenneth: Mycology of the Mouth, New York, Longmans, Green & Co., 1903.

THE RESTORATION OF THE FACE AND A METHOD OF TAKING MEASUREMENTS BEFORE THE REMOVAL OF THE NATURAL TEETH*

By STEPHEN A. T. COXON, L.D.S.I., London, England

THE phrase "restoration of the face" does not here mean restoration after wounds and fractures, but restoration of the face by artificial teeth after the removal of the natural teeth from pyorrhea or other cause. The restoration of the face is perhaps one of the most important services, from an esthetic point of view, that the dentist has to offer.

In his hands lies the power to improve or mar the face; the restoration to the patient of some family characteristic. The setting up of artificial teeth is only too often a matter of chance, and if fair mastication and articulation is obtained, the dentist is satisfied. But facial restoration is left to chance; the result leaves much to be desired from an artistic point of view, and, with proper care, could be greatly improved. The setting of the natural teeth of the patient is often forgotten or ignored. In the lower dentures, often insufficient room is allowed for the lower front teeth and therefore dentures are unsteady. The models of natural teeth shown illustrate this point.

In endeavoring to restore the face to its original lines, the following procedure is adopted:

Before any teeth are extracted, a model of the patient's face is taken in plaster, the patient keeping the teeth closed. The plaster is tinted so that, in removing the mask from the cast, the difference between the mask and cast can easily be defined. The face is lightly covered with petrolatum. Small paper tubes are placed in the nostrils to permit breathing. Thin plaster is now run on the face, the mask following just below the orbit taking in the malar region, the mouth and chin. A strip of one-half inch bandage is embedded in the plaster to allow easy removal of the mask.

As soon as the plaster is set, it is removed from the face, washed out with "Hudson's" soap to allow of easy separation from the cast, and, as soon as sufficiently hard, separated.

We now have a model from which we can take measurements and one that gives the accurate height of the bite, the natural droop of the mouth and the fulness of the lips and cheeks.

Impressions of the natural teeth are now taken, before any teeth are removed.

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis, at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

It is suggested that this be done when the patient's teeth are in good order, and that the impression be kept till required.

The measurements of the face are taken in the following manner:

Fig. 1.—Models of natural dentures available for reference in setting up artificial dentures.

A piece of Stent's composition, rolled up until it is a little thicker than a pencil, and about 10 inches long, is put into hot water and pressed down on the model, following the line from the bridge of the nose over the lips and under the chin. A piece of soft copper wire 46 standard gage is adapted to the model, following the line of the Stent's composition. A piece of lead wire 8 inches long is soldered in the center to

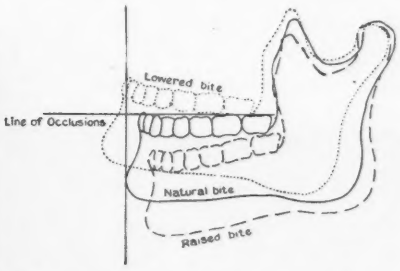

Fig. 2.—Variations from natural occlusion.

the copper wire at right angles, immediately above the upper lip. The wire is now heated and pressed into the composition to give it strength.

The lead arms can easily be bent to touch any part of the model, and when again placed on the face after extraction, show at once where there is any

Fig. 3.—Face prepared for plaster mask.

shrinkage. The vertical portion will give the original height of the bite. The lead wire is placed immediately below the nose for the reason that it alters

very little on the removal of the natural teeth and is practically equally distant from all points of the dental area of the face.

Before the natural teeth are extracted, the patient is asked to open the lips, keeping the bite closed, and a piece of Stent's composition is pressed on them.

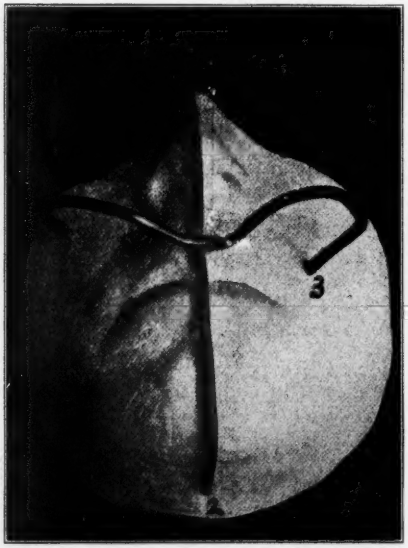

Fig. 4.—Lead caliper, showing method of taking measurements.

The caliper of the face is applied and the composition pressed round it. This gives the original relations of the lips and teeth.

The models of the natural teeth standing are now used to get an impression in clay. Ordinary modeling wax is melted and poured into the impression, and as it sets, part of it is allowed to run away, leaving a thick shell of wax over the clay impression. The wax is chilled. The clay removed, and we have a replica of the teeth before extraction.

The teeth are now extracted.

Impressions of the edentulous mouth are now taken in plaster. A sheet of modeling wax of the thickness we wish the vulcanite plate to be is pressed over the model and cut into shape, and a counter model is cast to this in ordinary plaster, which is opened and the wax plate taken out. A gate is cut and, without any heating, fusible metal is poured into the space.

The counter is removed and, on the model we have an accurately fitting plate that will not bend when the case is tried in the mouth, and one that can be cut with a hot spatula as easily as wax. When it is tried in the mouth, it will be known at once whether the impression is a good one.

Fig. 5.—Upper denture, showing hollow-cheek distenders.

The wax shells of the natural teeth are now fixed to the impression on the caliper with hard wax. The wax is melted and allowed to become plastic, and a ridge of it is mounted while it is still plastic on the base plates, which are dressed with tragacanth to hold them in position. The patient is asked to open the mouth, and the wax shells attached to the caliper are passed in, and the patient again closes the mouth. The caliper

must conform to the line of the face. The soft plastic wax will be squeezed into the shells and will fix them in the true alinement of the teeth that have been extracted.

The whole is now placed in the bite frame. The wax teeth are cut off one by one and artificial teeth substituted, representing as nearly as possible the natural teeth. The waxing up is completed, it is tried again in the mouth and any alterations that are desired can now be made.

The caliper will give one the fulness of the face and lips before extraction and the plaster models taken before extraction will serve as a guide to the position of the teeth.

Flasking is done in the ordinary way. When the flask is heated, the fusible metal will run away with the wax and should be collected from the bottom of the receiver into which boiling out is done.

The above described method is given as an illustration and in an endeavor to give a technic for restoring the face to its natural lines other than the haphazard method of setting up teeth by guesswork.

FACTORS THAT MAKE THE MOUTH AND TEETH A VITAL ORGAN*

By B. B. McCOLLUM, D.D.S., Los Angeles, California

INTRODUCTION

HISTORY of Dental Aims.—For a long time, dentists have been taught dentistry as though it were a problem of individual teeth, and they have believed that nice fillings, crowns, bridges and plates are dental aims, ends in themselves. They have been slow to consider articulation as the main idea of dental operations. Even orthodontists have, thus far, made only a feeble attempt in this direction. They have been more concerned with pleasing tooth alinement and static closures, stressing primarily the cosmetics of the mouth without regard to its functional movements. They have falsely assumed that the teeth would function properly, if they were in nice, even centric occlusion. To date, the prosthodontist has been the only one to consider seriously the problem of articulation. His first interest in it sprang from a desire to make his work permanently stable and serviceable.

The partial denture prosthodontist has found it necessary to follow the lead of the full denture prosthodontist, and to go even further, in an attempt to analyze and understand the components making up the function of mastication. Like the orthodontist, he deals with natural teeth, which, for many reasons, are seldom in proper relation. Formerly, most of the partial denture appliances were made with a view to filling spaces with as little intrusion as possible on the articulation, no matter how abnormal. These appliances were never con-

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

sidered as remedies but as palliative substitutes—tooth crutches—and, as other teeth were shed, these *things* were made larger, until full dentures were made.

Lately, a certain school of dentists, believing that articulation is paramount therapeutically and assuming that it is the governing factor in facial growth, have, in making partial dentures, reconstructed the whole articulation of the mouth arbitrarily without regard to the *status quo* of mandibular rotation axes, in the hope that they would correct jaw deformations in size and position. That is, they believe that by inserting partial denture appliances and by reshaping the natural teeth, they can change the mandibular angle and the paths and positions of the condyles; open the bite or jump the bite, or close open bites; or even gain a certain amount of expansion in contracted jaws; in short, correct most of the obvious symptoms of malocclusion and, thus, really remedy the mouth, face and body conditions by directing the masticatory forces on toward what they consider normal conditions. Since vertical corrections or changes made in the mouth are most easily discernible by the dentists, this new departure in dentistry has been called "opening-bites." But, in this, the partial denture maker has merely realized that his appliances should be remedies, not space fillers, that fillings, crowns, bridges and plates are the chief remedies to be used and combined in such a manner that function and health are established, restored and maintained.

The Rational Aim.—However, the rational aim, it seems, is to assume that the mouth and teeth are a vital organ; that the main object of dentistry is to make the patient able to eat, which, if really accomplished, will provide the greatest protection to the mouth itself, and, by restoring mastication amply, will have a wholesome effect on the body, and will give dental restorations the highest esthetics.

The logical procedure, it seems, is to locate the rotation centers accurately and restore the cusps and ridges of all the teeth and the appliances so that they, cooperating with mandibular movements, will function efficiently and harmoniously. In constructing the appliances, all corrections possible in the arch form, denture height and length should be made coordinately and simultaneously with the needed reconstruction of all the occlusal surfaces of the natural teeth. In such work, we should not lose sight of the fact that it is our business in the first instance to leave the patient provided with a capacity to chew food comfortably and well.

History of Dental Attitudes.—Spencer R. Atkinson, Pasadena, Calif., suggests that the crowns of the teeth, after once being formed, are the only tissues in the body not subject to change of shape and repair. Other tissues can by changing in size and shape adjust themselves to the conditions submitted, but the teeth can only be accommodated or worn, and any change of shape or repair must be done by artificial means.

The question of natural wear is of serious importance. Wear robs the teeth of their ability to act as functioning implements, and, as it progresses, reaches a point where the investing tissues are dangerously involved. Much has been written about the readjustment of the denture to compensate for wear by grinding off the high spots and grinding in new contour and contacts. No

doubt, if this is done judiciously, some permanent good and considerable temporary relief can be accomplished in that way. But a worn out set of teeth requires and deserves our most careful attention and, where the wear has made the occlusal surfaces smooth planes and cusps, nothing but rejuvenation by rebuilding will suffice. It would be impossible, except in a very unusual case, to grind in new grooves and fissures to remake the ridge edges so necessary to mastication. No doubt, nature provides for a certain amount of wear and, until it has progressed so far as to obliterate the cutting ridges, the uneveness of the wear can surely be cared for by grinding. No attempt should be made to so treat this condition without first making mounted models and from them obtaining a study of the articulation. So far, the periodontists have made mounted models largely for the purpose of detecting the high spots and not with a view to restoring the multiple cutting edges of the teeth.

Nature of Chewing.—Articulation is the consummation of the proper arrangement of all the components of the masticatory apparatus expressed through the implements of mastication—the teeth. The teeth form a sort of battery by which the food is attacked. After the incisors have cut off the food, the bicuspids and molars grind it up by a multiple shearing process, the cusps and ridge edges of the opposing teeth forming the shears. Stallard[1] describes this process for the first time. The teeth are merely the implements of the masticatory apparatus. Through them, the function of mastication is performed. In order to have good mastication, we must have good tooth form, proper cusps and ridge coordination, providing a battery of shears that work in harmony with the movement of the mandible about its rotation centers. These few simple factors make the mouth and teeth a functioning organ, which reaches its highest state of perfection in jaws normal in shape and calcification.

Attitude of Dentists.—Dentists have not yet learned that the mouth and teeth constitute an important organ; that its chief function is the beginning of the digestive process, without which growth and body activity cannot be maintained, and that this function cannot be dispensed with, without serious consequences. The mouth and teeth are an organ that is vital to the well being of the individual.

Dentists do not recognize nor believe that their field of operation is fundamentally important. It is easy to prove that the majority of them do not regard chewing, the mouth's chief function, as of much consequence. A casual survey of practiced dentistry proves this fact beyond question; for only in rare instances do restorations enable or permit the mouth to function as an organ of digestion.

Attitude of the Colleges.—The individual dentist is not so much to blame, because the colleges are still neglecting, or at least failing, to teach dentistry from the standpoint of oral health and what constitutes healthy functioning of the mouth. The modern student is not made to realize that the whole masticatory apparatus is his field of operation and that only a coordinated unit can perform the function of mastication.

1. Stallard, Harvey: Functions of the Occlusal Surfaces of the Teeth, J.A.D.A., 13: 1392 (Oct.) 1926.

Orthodontic Aims and Courses.—Orthodontic courses have altogether disregarded the relations of the teeth to the mandibular centers of rotation, to the paths and positions of the condyles and to the slant of the curve of Spee in regard to the horizontal or condyle-orbital plane of the face. Simon, with his gnathostat and photostat, has done something toward orienting the plaster models of the denture in their position relative to the head and face, though only in a static way. Orthodontists need to concern themselves with these dynamic problems of articulation, giving heed to the originating and limiting factors of the movements of the mandible. They should become our best sources of information regarding the problems of occlusion, and particularly articulation. It is not enough for them to stop when teeth have proper closure mesiodistally: the teeth should occupy proper positions in the masticatory apparatus and there must be a harmonious and efficacious interdigitation of the various cusps and ridge edges.

Surgeon's Lack of Vision.—Courses of surgery and the attitude of the oral surgeon in colleges have not been conducive to constructive dental thought, for, in their ignorance of articulation and the vitalness of the mouth as a digestive organ, they have, in collaboration with the physician and the general surgeon, looked on our field as a fruitful source from which to explain elusive, obscure and otherwise baffling symptoms and to recommend the removal of teeth just as if they were so many therapeutic pegs. We, as a profession, have been unduly prone to cooperate in this destructive attitude and have been led to believe that we were practicing dentistry when we were only destroying the vital function of the mouth to the great detriment of our patients and our profession. We have ofttimes been led away from our true aim and purpose; that is, maintaining and developing the masticatory function.

Influence of the Surgeon Nationally.—A few years ago, the American Dental Association had a slogan "Ten Years to Human Life." Did these words indicate a genuine realization and recognition of the true import of the function of the mouth and teeth as a necessary organ of digestion? I fear they did not. Eradication of infection seemed to be the key-note, and function was relegated to the background. That "Ten Years to Human Life" will never be realized until the mouth and teeth are considered the vital organ of digestion that they are.

THE VITALNESS OF EATING

Its Universality.—Every living organism needs some means of taking in a food supply. Only those one-cell organisms that are more or less completely bathed in a medium of absorbable nutriments need no mouth. If the food particles must be picked up in an unprepared or semiprepared state, and the body must pour out its digestive fluids, an engulfing device, or mouth, becomes necessary. The most primitive mouth is a simple invagination of the exterior wall of the one-cell organism, a temporary impouching made at the convenience of the organism and, no doubt, brought into being by chemical forces, chemotaxis, perhaps, for the sole purpose of holding the food while it is being digested. In the advancing scale from the simple to the most complex organisms, the mouth becomes a more defined, complicated and impor-

tant organ, until, in man and the higher animals, its functions cannot be dispensed with, without destroying the comfort, health and, eventually, the very life of the individual.

Primitive Purpose Vital.—The most primitive purpose of a mouth is to obtain and maintain contact with food, the raw fuel of life. But since all parts of the organisms store up energy, or a reserve fuel supply, death from starvation does not result immediately but follows long after the last food was ingested. We have been taught to regard as vital those organs whose removal or destruction causes instant death, such as the brain, heart and lungs. We now know that the thyroid and pituitary glands and the spleen are vital organs, although their complete removal does not result in an immediate death. The bodily activities and life cannot be carried on for very long without them; hence, they are vital organs. A man may lose his eyes and suffer the greatest inconvenience but live out his full span of life.

The Mouth, a Vital Part of the Digestive System.—In its primary purpose, ingestion of food, it is easy to see that the mouth is vital to man's existence. It is true, no doubt, that a man might exist without a mouth just as he could without a stomach, but it would be a short existence and in no sense living. Man's mouth, however, is more than a receiver of food. It is an integral part of his digestive tract, and its function is mastication—chewing and insalivating food.

Mastication Vital.—All dentists may agree that the mouth is made for mastication and that the teeth are the instruments used for this purpose, but how many realize the vital necessity of this function? Most foods, if allowed long enough contact with the enzymes of the digestive system, will be liquefied eventually, but such a process in man must be expedited by mastication. Many animals require mastication as a part of the digestive process. Animals, such as the horse and cow, quickly succumb when the masticatory apparatus does not function, and chickens and kindred birds must have a supply of the right kind of gravel in order to live. Just how vital this masticatory process is to birds may be easily demonstrated to the satisfaction of any one interested enough to try it. Animals, such as snakes, which swallow their food whole have a special digestive enzyme for breaking up or preparing the food.

No Substitute for Mastication.—We can safely say that to any animal which is by nature so provided, a masticating organ in good functioning order is essential to the life processes and any injury or diminution of this function is reflected in the health or longevity of the subject. In man, if mastication is not thoroughly performed, the food being in large pieces, ferments or putrefies before the digestive enzymes can do their work, and many unpleasant symptoms result. Cooking and other artificial means help to prepare man's food; but preparation by unnatural methods robs eating of its real pleasure, and the stomach and the rest of the digestive system are not prepared by the stimulation of taste to carry on their work to their best advantage. It is mastication that brings out the taste of food.

SECONDARY FUNCTION OF THE MOUTH

Speech.—The mouth is also adapted to speech and expression of emotions. Both of these functions are secondary and by no means vital. It has been supposed that well arranged teeth are always necessary for good speech but

the degree of defective speech never runs parallel with mouth deformations, except in cleft palates. Many children found in classes for correction of speech have fairly normal dentures, while many individuals with badly deformed mouths speak with ease and precision. Good speech depends more on the mental and nervous coordination of the individual, although a well formed mouth may enhance the quality of speech.

Looks.—The teeth also contribute much to the beauty of the face, and nothing more quickly mars or destroys an attractive, youthful appearance than a badly cared for or defective set of teeth. It is small wonder, then, that so much attention has been focused on the teeth, even to the point of making them the paramount objects of our endeavors.

MISDIRECTED ENERGY OF DENTISTS

Orthodontic and Operative Failures.—A great part of our energy has been misdirected. We have seen our efforts as operators on teeth fail, not because the restorations were intrinsically bad, but because the activating forces and the supporting structures of these implements were utterly disregarded. The orthodontist wants his work to be successful. Has he the right to expect success unless all the essential parts producing masticatory function are known and duly regarded? Not the least of these elements are the dynamic centers. Malposed teeth are often accompaniments of deformed jaws and are not at all a cause or result of such defects; yet by means of intra-oral appliances, the malposed teeth are pushed or pulled about, to be later turned loose, in hope, no doubt, that, by natural forces, they will ultimately relate themselves properly to the uncharted and really unknown dynamic centers. Most orthodontic work is today done without measuring devices or with no regard to the movements of the mandible. It is not at all uncommon to hear orthodontists proclaim that you can't measure the work of God; meaning that you cannot apply a rule or compass to the mouth, when, as a matter of fact, no progress is made anywhere in science except as measuring devices are invented or improved.

The dentist of the future will not boast of the gold or amalgam filling that has "stayed in" for forty or fifty years in a mouth wholly lacking in masticatory function and in a state of unspeakably bad health. Fillings, crowns, bridges and plates are but the alphabet of dentistry. They have value only when combined in a proper manner, just as letters convey ideas when combined into words, and words arranged into sentences convey thoughts. Literature is more than letters. Dentistry is more than its alphabet. An operator may make any or all of the letters beautifully, but without the sense and understanding of their correct combination, he will fail to accomplish any good purpose. Beautiful fillings, crowns and bridges, in themselves, do not constitute good dentistry any more than pretty, artistic letters are good literature.

Mechanics and Function.—Mechanics and function constitute the proper basis for a study of dentistry, but only patient and careful analysis can lay the foundation for conclusions. Good and thorough mastication depends on the correct physiomechanical arrangement of the various parts of the masticatory apparatus, and particularly on the correct articulation of the teeth, the harmonious joining and gliding of

the opposing teeth during the act of chewing. So important is a full understanding of the whole mechanism that it would not be out of place to change our appellation from dentist to gnathologist, one versed in the science and art of the treatment of the masticatory apparatus.

Dentistry Vs. Gnathology.—"Dentist" does not express the full import of our work and, too, the word dentist has come to signify a tooth carpenter, a tooth tinker, mechanic. We have a precedent for changing our name. When astronomy was first being developed into a science, it found the proper name for its activities had been usurped by a pseudoscience—astrology. Believing that the word had become so firmly imbedded in a misconception of the real purpose that they had in mind, the men of that day decided to coin a new word, and so named their science astronomy and called themselves astonomers. We have a much better reason than they had. "Dentist" is badly misunderstood by the general public; besides, it does not and never did adequately express what we should have in mind as "gnathologists."

Poor Evaluation of the Mouth.—The dental profession does not occupy a dignified and honorable position, but perhaps as high a position as its present importance to humanity entitles it. To correct this condition, dentistry must undergo a fundamental radical change in its methods and aims. Dentists themselves must experience a profound transformation in their evaluation of the mouth. An analysis of the present-day attitude of the laity and other professions towards us proves that our services are not looked on as essential to the happiness and well-being of those to whom we administer treatment. This attitude is nothing more or less than the reflection of the dentists' own misconception of the relative importance and dignity of the tasks undertaken in the care of the mouth.

It is a sad commentary on our honesty of purpose that the greater portion of the present-day operations are for people who have come to us because compelled to have their mouths reoperated on. Behind all this ruin is a simple cause: a weak and vacillating profession, which does not stand flat-footed for just one thing, the best knowledge and skill for every undertaking. Such an ambition, such a course, will place us on the professional level which the importance of real gnathologic work deserves and will rid us of a commercial aspect that bids fair to swamp us ultimately. Correction of mouth conditions requires honesty of purpose as does no other professional operation. Not even nature herself steps in to heal our blunders, and money cannot buy back that which may have been destroyed. When the importance of the mouth and teeth has sunk deep into the consciences of the dentists, and the far-reaching effect of even the simplest undertaking has dawned on us, our profession will deserve to be and will be properly appreciated.

ARTICULATION

Factors.—The objective and concrete factors of articulation are: correct tooth form, proper number of teeth, right positions of the teeth in the arches and a faultless relation of the arches to each other and to the head and face.

Misshaped Implements.—If teeth are misshaped by being too small or too large, or uneven in form, or lacking proper cusps, or having too many or too few cusps, the function of articulation

may be abbreviated or perverted by the cusps lacking proper coordination. All the teeth may be affected in individuals who have had profound nutritional disturbances in infancy, or a single tooth, such as a peg lateral incisor, may create a condition as bad as would obtain if a maxillary tooth were absent.

Missing Implements.—If one or more of the teeth are missing or malposed, the cusps and ridges become so misplaced and confused that the process of shearing is absent or destroyed and the mouth becomes not an organ of digestion but a mere food-receiver—a hopper. Unless the proximal relation of the teeth is almost perfect, injury is done to the investing tissues, and a series of pathologic conditions result that sooner or later cause serious trouble. If the articulation of the cusps and ridges does not properly harmonize with the activating forces, this energy is misdirected, and the investing tissues of the teeth are traumatized, often to the point of destruction.

The malarticulation of the teeth may be the result of malposed implements, misshapen implements, lost implements, wornout implements or implements mutilated by the dentist. Any or all of these malconditions will lessen the functioning capacity of the mouth and, in many cases, rapidly bring about destructive processes that soon ruin the mouth and turn it into a breeding ground for infective foci.

Misplaced Arches.—In the various jaw deformations, the upper arch may be too far posteriorly or too far superiorly in the face, even too far anteriorly. It may be too far posteriorly and superiorly at the same time, thus causing all of the teeth to be out of harmony with the dynamic centers of the mandible and the arcs described by the mandibular teeth. Likewise the lower jaw and the mandibular arch may be too far posteriorly, too far anteriorly, or too far superiorly in the face, or possess two of these in combination, or the reverse abnormalities, and thus all the arcs made by its cusps and ridge edges will be out of harmony with the maxillary cusps and ridges.

Malocclusions are seldom as simple as they seem when viewed in plain plaster casts or in the mouth, apart and aside from measuring instruments. Whether the condyles are misplaced or the jaws merely bent, in cases of arch displacements, it is hard to determine or measure, but it is reasonable to suppose that harmony can be established by leaving the axes as they are and harmonizing the elements of the denture with the movements of the mandible.

Functional Vs. Anatomic Malocclusion.—The practice of having the patient "jump the bite" may be justified by the assumption that the patient acquired the anatomic deformation by functioning of the teeth distally. However, it is questionable that the deformation is even partly corrected by having the patient simulate normal tooth relations by protruding and keeping the mandible forward with the condyles resting on the eminentias.

DIAGNOSIS

Requirements.—In order to diagnose the disarrangement of the components of any organ, it is necessary to have and use instruments to measure the aberrations, and treatment is but a reduction of the number or severity of the aberrations. Many, practically all, dental lesions are not healed by nature, but require some mechanical remedy to assist in establishing or maintaining func-

tion. For this reason, instruments are particularly necessary in diagnosing diseases of the masticatory apparatus. For this purpose, we have the roentogen ray, which reveals and records much of importance. We can construct accurate models of the two arches. These models, in themselves, will show many defects that could not be observed in the mouth, besides making a record of great value. But the true value of the models is apparent only when accurately opposed on an instrument that will reproduce and record the movements of the mandible. This instrument must also show the position of the arches as they are related to the head and face. With such an instrument and accurate models properly mounted, it is possible to determine the kind and severity of the aberrations in a way never dreamed of heretofore. In order to complete the records, and make them valuable for future reference, it is necessary to have instruments for determining and recording the positions of the dynamic centers and the condyle-orbital plane of the face.

As each individual varies, each case will determine its own measurements and, hence, its own fate in treatment.

Mechanical formulae, geometric quints and arithmetic will not set an articulator or measuring treatment to disclose or reproduce the movements of the mandible. Lack of knowledge is the only excuse for any arbitrary formulae or adjustments of a measuring instrument and the dental articulator is nothing but a more or less complicated measuring instrument.

Features of a Diagnosis:—The outstanding feature in diagnosing functional defects is the relation of the cusps and ridges of the teeth, especially during articulation. If the teeth are malposed or misshapen, the cusps and ridges do not properly coordinate and the shearing action is wanting. If there are teeth lost, function is more than proportionately decreased and the remaining teeth drift out of position, and soon function is destroyed to a great extent.

When the teeth are worn, the occlusal surfaces become smooth and the shearing process is destroyed. In any of these conditions, the food is not properly triturated, and the fibers are not cut but crowded against the gingivae, particularly between the teeth, which causes injury to the septal tissue, with the well-known sequelae.

No matter what the malconditions may be, no matter how insignificant the situation may seem, any case coming to us for treatment deserves a careful analysis of the mouth's ability to function as an organ of digestion. As the teeth are the implements, or passive instruments, of this function, it is necessary for us to see to it that their form, number and arrangement are conducive to the performance of this purpose; that their investing tissues are protected, and that, as far as our knowledge and skill permit, all the components of the masticatory apparatus are working in harmony.

A Hard Task.—The partial denture prosthodontist has the most difficult task in dentistry and too much time and thought cannot be given to the analysis of the conditions that are presented for treatment.

TREATMENT

Main Consideration.—The deformities of the jaw and the malposition of the teeth must be studied and analyzed with a view to their correction or ameli-

oration by mechanical remedies. These remedies must be acceptable substitutes for missing teeth or parts of teeth, and they must not, by their presence, produce any pathologic conditions else the remedy is worse than the disease and the operation is a failure. As has been mentioned before, the ingredients of our prescriptions are the elements of dentistry; namely, inlays, crowns, bridges, attachments and plates, etc. They should be used and combined to institute cures, and to restore function, not merely as decorations.

Malposition of Teeth.—Where the teeth are malposed, the logical treatment, if at all possible, is undoubtedly orthodontia. The question of retention is today the uppermost problem of the orthodontist. We will never know whether the teeth, placed in proper arch formation with the arches correctly opposed and in the right relation to the head and face, will be automatically retained until somebody tries it. We do not know whether those cases which do stay in position are retained because of a harmonious relation between the components of the masticatory apparatus, because orthodontists have not analyzed their cases with the dynamic centers and the relation of the arches to the head and the face as a basis of their study and records.

When teeth have been lost, artificial substitutes should be placed before the rest of the teeth have shifted their positions and destroyed the articulation. If the teeth were, or have become, malposed, and age and opportunity permit, orthodontic measures should be used to correct the malposition before substitutional remedies are placed, and if the work is done in a reasonable time, a long retention period is not necessary before inserting the remedies.

Wear and Worn Teeth.—In many cases, if the teeth have been lost for some time, there has been rapid wear of the occlusal surfaces, probably because of the malposition developed in the remaining teeth, and the cusps and ridges are well nigh worn off. It has been customary, in such cases, as is strongly and almost vehemently avocated by some operators, to imitate the worn condition of the natural teeth in the remedial substitutes. Why should not our object be the rejuvenation of this vital organ to the highest degree in our power? To put on the proper cusps and ridges does not lock the teeth in occlusion but will still allow free and desirable articulation.

To cut off or build up the teeth to accomplish articulation is often a necessary procedure, but it can be done only after proper and accurate measurements and calculations have been made. In many cases, our limited knowledge, or the refractoriness of the condition to be dealt with, makes it impossible to accomplish everything desired. Judgment then becomes our guide; but only a judgment based upon an intelligent investigation is worth anything to us or to our patients.

We must be careful to avoid undue interference. But to perform an operation in a way that is pleasing and satisfactory for the time being, but which experience and judgment tell us will fail and in its failure do further damage, is nothing less than criminal.

Anchorage to Save Articulation.—To avoid cutting a tooth that is out of articulation or that is to be used as an abutment to support a substitutional remedy, just because it is free from

caries, is to miss the main purpose of the partial denture prosthodontist. To leave a tooth out of articulation not only injures that particular tooth but may—and more than likely does—ruin the whole mouth. In all the wrecked mouths that present themselves for *retreatment*, most of the fault for the failure can be traced directly to a lack of articulation, and this lack of articulation is often the direct result of an effort to avoid cutting a so-called sound tooth. No tooth is sound that is not doing its part, and any tooth that is not functioning as an implement of mastication is a menace to the welfare of the mouth. More mouths have been ruined by the lack of understanding of this principle than from any other cause.

CONCLUSION

In the clinic to be presented by me, I have done my utmost to reinstate masticatory function by obtaining proper cusp coordination, leaving the condyles to rest in their original positions, though I have, in other cases, changed the functional position of the condyles. I have tried to reestablish the cutting edges, ridge by ridge, so that that they will function like scissors. I have exhausted what knowledge is available in diagnosing these conditions, in preparing the mouths to receive the appliances and in rebuilding the implements of mastication. No pains in skill and application have been spared, because I believe the mouth deserves such attention. The possibilities of this work are so great that men will attempt its kind just in proportion as they learn of the vital importance of mastication, articulation and the dental apparatus.

This method of treatment may be replaced in the future by better processes. The materials used, no doubt, will give way to better substances; but the aims and purposes of such work shall long prevail, and man will always need dentists to perform such acts, even if caries will ultimately be prevented.

Let no man imagine that dentistry will become easier as we eliminate caries. In those races in which caries was almost unknown, most of the individuals reaching the age of 45 suffered much from wear, because they had been able to and did use their teeth; and they would have profited greatly had their mouths been restored to function by the procedures here outlined.

MY EXPERIENCE WITH INAVA VACCINE IN THE TREATMENT OF PYORRHEA ALVEOLARIS*

By EUDORE DUBEAU, D.D.S., Montreal, Canada

THREE years ago, while I was traveling in Europe, my attention was attracted by a vaccine called "inava," used in the treatment of pyorrhea, and after reading a few articles written by eminent dentists and stomatologists on that subject, I decided to investigate.

As the treatment by this vaccine was based on the theory of Besredka concerning local immunization, I went to the Pasteur Institute and saw Dr. Besredka, who was Dr. Metchnikoff's assistant in his laboratory work and who took his place after his death.

Knowing that Dr. Goldenberg, who first prepared this vaccine, had worked under Besredka's supervision, I asked him his opinion. He said: "I cannot at present say that this vaccine is a specific cure for pyorrhea, but the results that I have seen are so excellent that I think it is entitled to serious consideration."

Returning to Montreal, I brought a supply with me to experiment with in our clinic, at the Faculty of Dental Surgery of Montreal University. It was used under my personal supervision in sixty cases with very satisfactory results, and in some cases the effect on the general system of the patient was astonishing.

The following year when I was in Europe, I was asked by G. A. Roussel, president of the American Dental Society of Europe, to give the results of my experience at their annual meeting in Amsterdam, Holland. My paper brought a lengthy discussion, and I was pleased to hear Dr. Valladier, of Paris; Dr. Brydges, of London, and Dr. Aguilar, of Madrid, say that their results were exactly like those I had obtained.

Since then we have continued its use in our clinic and I have used it in my private practice, which is now confined to the treatment of pyorrhea, with the same good results.

I am not a bacteriologist, and consequently I am not competent to discuss the bacteriologic side of the question. I have discovered nothing; I have only tried a vaccine, which Dr. Besredka, as high an authority as can be found in the scientific world, told me deserved an honest and serious trial, and I am pleased to give you the results.

The use of this vaccine does not exclude the surgical side of the treatment; it is only an adjuvant to the treatment, and the curetting of the pockets must be done as in any other method of treatment, but it should not

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be started until after the second injection, when the vaccine has entered the system.

My procedure is as follows: I insist on the cooperation of physician and dentist. Some claim that, as in typhoid fever, diphtheria, etc., a physician should be called to make the injection. I do not think so; but if you cooperate with the physician, besides doing what is right, you will have his sympathy instead of his antipathy. I first ask the patient to have an urinanalysis made and bring the report to me. If the urine contains some sugar or albumin, I refer the patient to his physician for treatment, as in these cases, the injection of vaccine may be followed by some disagreeable reactions, and I postpone the treatment until the general health has improved. If there is no sugar or albumin, I prescribe a mild laxative for two or three days previous to the first injection of 1 drop. Four days thereafter, if there has been no reaction or a very slight one (and it seldom occurs), I inject 2 drops, and then, every two days, I make an injection, increasing the dose by 1 drop each time, until a dose of 6 drops has been obtained, then injecting 6 drops each time until the series of ten injections has been completed.

As I mentioned before, I start curetting only after the second injection, and I do some at each subsequent sitting. The injections should be made in the cuspid or bicuspid region in the mucous membrane as superficially as possible, and slowly. The gum should not be massaged, as slow absorption is desired. Injection of 3 drops or more should be made in two different places, to lessen irritation.

Strict asepsis of the syringe and needle must be observed and also regularity of injections. If, on account of reaction or for any other reason, the treatment has been stopped temporarily, the number of drops injected at the following sitting should be the same as at the previous one.

An injection of 1 drop of this vaccine in the mucous tissue before the extraction of an impacted third molar or an abscessed tooth will prevent subsequent infection.

I know that some are not in sympathy with the employment of this vaccine or have been unsuccessful in using it, which may be due to the fact that the vaccine was too old, or the technic employed was faulty. I insist on injections at regular intervals, strict asepsis, careful dosage and the use of a proper syringe, such as the one made in France for this purpose. More than one series of treatments should be given, if necessary.

SUMMARY OF CASES[1]

CASE 1.—A man, aged 30, whose gums had been in bad condition for several years, with no pus present, was given ten injections. There was no reaction, and the result was perfect.

CASE 2.—A woman, aged 50, had retracted gums with pus present. Ten injections were given, with no reaction, and very good results.

CASE 3.—A woman, aged 40, had pockets extending to the apex, with an abundant flow of pus. Ten injections caused no reaction, and the result was perfect.

CASE 4.—A man, aged 50, whose teeth were loose and gums retracted, with much pus present, had ten injections, with no reaction and very good results.

CASE 5.—A woman, aged 33, in good physical condition, had five teeth around which pus was exuding. She was given ten injections, with no reaction and a perfect result.

1. Cases 1-4 were treated by the author.

CASE 6.—A man, aged 30, in good physical condition, but with pus exuding from all the upper teeth and three lower teeth, was given ten injections. There was no reaction, and the results were perfectly satisfactory. The flow of pus was stopped and the gums resumed their normal color and texture.

CASE 7.—A woman, aged 40, in bad physical condition, with pus exuding from around all the teeth, was given a series of injections, but the result was not good. Another series of treatments will be given her.

CASE 8.—A man, aged 35, in good physical condition, but with pus exuding from around eight teeth, and the gums in very bad condition, was given ten injections. There was no reaction, and the condition was greatly improved, but further treatment will be necessary.

CASE 9.—A man, aged 54, who was very nervous and suffered from intestinal and other systemic disturbances, was given ten injections, with no reaction and a perfect result.

CASE 10.—A man, aged 33, in good physical condition, was given ten injections, with no reaction and a quite satisfactory result. The health of the patient was much improved.

CASE 11.—A woman, aged 37, in bad physical condition, suffering from congestion of the gums, with much pus present, and from violent headaches, was given ten injections. The gums took on a healthy appearance, the headaches ceased, and the patient gained 8 pounds and felt and looked well.

CASE 12.—A man, aged 33, suffering from nervous depression, was given ten injections, with no reaction and a splendid result locally and sytemically.

CASE 13.—A man, aged 58, in a poor state of health, with anemia and rheumatism, and a very poor oral condition, the teeth being loose, breath foul and vomiting a frequent occurrence, was given ten injections. There was no reaction, and the result was perfect; i. e., teeth solid, gums healthy, and the general health much improved.

CASE 14.—A woman, aged 30, who had had diphtheria and pneumonia, and was in very bad physical condition, suffering from stomach, intestinal and renal disturbances, and whose gums were in bad condition, with much pus exuding, was given ten injections. A mild headache was the only reaction, and there was 75 per cent improvement. The patient has a better appetite and feels better.

CASE 15.—A woman, aged 55, in poor physical condition, and with marked exudation of pus, suffered no reaction from the treatments and the result was considered entirely satisfactory.

DISCUSSION

Isadore Hirschfeld, New York City: It is to be regretted that the time set both for the lecture and for the discussions is so limited. It is inconceivable that the many phases of the subject can be adequately discussed and covered in so short a period. I have the greatest respect for the conscientious experiments carried on by Dr. Dubeau and he is to be particularly commended for the precautions he takes in regard to the general health of the patient prior to the vaccine therapy. It has been my experience that two out of eight cases selected for vaccine treatment were eliminated by an internist as risks for vaccine therapy. Yet it seems that, from among the numerous writers whose favorable reports were procured by the American agent of the inava vaccine as testimonials in a pamphlet mailed to the profession in connection with the advertisement of this product, Dr. Dubeau was the only one who expressed the importance of such a step. He makes the statement, as do the other men in the reports embodied in the compendium, that the vaccine will not yield the desired results unless all other steps usually taken in the routine treatment of so-called pyorrhea are faithfully carried out along with the vaccine therapy; in other words, that the vaccine is not a specific but merely an adjunct. Similar provisos have, in the past, been made by manufacturers for reputed "remedies," which have since then been proven worthless. Such recommendations, then, at this time, must arouse a doubt as to the actual benefit derived from the vaccine itself. About two years ago, a group of periodontists headed by Dr. Stillman, the president of this Section, requested me, on account of the facilities at my disposal, to run through a series of tests of this vaccine. I welcomed the opportunity of ascertaining for myself the approximate degree of its usefulness. In fairness to the manufacturers, I had associated with me in these tests operators in dental clinics who had more than average experience in the treatment of periodontoclasia. Cases were selected in which individual areas failed to respond to the serious efforts of either these oper-

ators or myself, through the usual conservative methods of treatment. Although we appreciated the importance, from a strictly scientific point of view, of having a large number of test cases, our number was limited to six, because it was difficult to find cases that were suitable locally for the experiments, and because, as previously stated, two out of the eight patients originally selected were eliminated by an internist as risks for vaccine therapy. These test patients were observed before and after the series of treatments, by the entire group of those interested, including among others, Drs. Stillman and Merritt, the latter then president of the American Academy of Periodontology. The preparation of the cases for treatment consisted of a thorough physical examination by an internist, an analysis of urine and blood and the bacteriologic examination of smears and cultures from the pyorrheal pockets, both qualitative and quantitative. Parallel bacteriologic tests were carried out independently by two bacteriologists, whose findings were checked up by a third. Reliable radiograms and sterescopic photographs were secured of the areas observed. The bacteriologic and photographic records were used for comparison later on with those made a reasonable time after the completion of the vaccine therapy series. Since the value of the vaccine cannot be measured definitely when used by an expert operator in conjunction with the usual routine treatment, because he generally gets satisfactory results in the average case of suppurative periodontoclasia without the additional use of a vaccine or any other medium, the tests were made on the basis of determining the following points: 1. What changes, if any, could be observed and attributed to the vaccine in a pyorrheal condition that received no other treatment than the use of the vaccine? 2. Can the average general practitioner, who is not an expert periodontist, accomplish with the vaccine what he could not without it? 3. What can the expert accomplish with the vaccine in instances in which he failed without it? Briefly, the following interesting observations were made: 1. A coincidental generalized marginal gingivitis remained unchanged after the completion of a course of vaccination. 2. In a case in which no operative work was done, the flow of pus was not affected in any way. 3. Where apoxesis was performed, but not successfully, the accessory use of the vaccine did not seem to lessen pus formation. 4. In one case, the pus formation, instead of diminishing, increased greatly after the first series of injections, and the second series left it in the same condition as at the beginning of treatment. 5. In another case, a parietal abscess developed beyond the area under observation toward the end of the second series of injections, while, at the same time, the amount of pus remained unchanged in the area originally observed. 6. The additional use of the vaccine either simultaneously with the course of operative procedure, or after it, failed to bring improvement. After a reasonable lapse of time, to permit any possible transitory influence which a stock vaccine might produce to wear off, intervention by an expert periodontist along conservative lines, did yield the desired result. 7. In two cases in which I failed in individual areas with the usual conservative means, one patient presented an upper second molar, with deep infections in the bifurcations, a condition admittedly of negative prognosis. In this case, it was evident that the additional use of the vaccine alone after operative treatment had, at best, a slight and transitory effect. 8. The second of the above mentioned patients presented a deep spiral pocket around an upper cuspid tooth. The additional use of the vaccine failed to bring results. Lack of time does not now permit a detailed description of the observations, but I regret to say that the members of the observing group found that the results were obviously unsatisfactory. A complete detailed report of the progressive steps in treatment and the results obtained in these tests was presented before the American Academy of Periodontology at their meeting last September at Louisville, Ky.[2]

Theodore D. Casto, Philadelphia, Pa.: Is it not evident that the time has arrived when dentistry should apply the remedies that have been found efficient in treating systemic diseases? Since the time of Edward Jenner's discovery of vaccination against smallpox, the progress, of immunization against disease by the application of attenuated cultures and treated serums has made a constant, if not

2. Hirschfeld, Isador: An Investigation of Inava Endocarps Vaccine, J.A.D.A., 13: 1613 (Nov.) 1926. McCall, J. O.: Minority Report on Vaccine Treatment in Periodontia, J.A.D.A., 13: 1624 (Nov.) 1926.

rapid, advance. So, I feel that the time has arrived when the bacteria invading the periodontal tissue should be treated by some form of local immunization. It is the privilege of the operator to decide whether he shall employ autogenous vaccine or select one prepared as the inava endocorp vaccine. I have, for the last fifteen years, prepared frequently, autogenous vaccines, and shall continue to do so in selected cases; but for general work, and in the majority of gingival inflammations, I shall adhere to the polyvalent stock vaccine. Besredka's postulate of local immunization, now applied generally in medicine, is particularly applicable to subepithelial injection in the region of the teeth. This injection is easily made, especially by a dentist. We must always remember that this vaccine is not a cure for pyorrhea, especially in its advanced stages, but when used for gingival inflammations in conjunction with other curative measures such as correction of occlusion, correction of diet and good scaling, it is very valuable. I approve physical examination of the patient A man, aged 35, did not improve readily after use of the vaccine and a complete laboratory test showed a 4+ Wassermann reaction. The patient is now undergoing treatment with arsphenamin. The method of injecting the vaccine and the dose must be studied very carefully as Dr. Goldenberger is very positive that there is only one way to administer the vaccine. Dr. Dubeau's description of the doses is quite complete, but permit me to emphasize that the vaccine must be placed just under the epithelium layer of the mucous membrane, half way between the gingival border and buccal margin and never in the muscular tissue. The area is painted with tincture of iodin and dried with air until there is wrinkling of the membrane. One of the folds is picked up with the sharp point of the needle and the thrust made very gently into the epithelium. The injection, when made, should form a small bulla. My method differs from Dr. Dubeau's in that I do not scale the teeth until after five doses of vaccine, as I have not seen any marked reduction in inflammation of the tissue until after the administration of four or five doses; and that is the period when I begin the surgical measures. I often recommend five doses of vaccine, given in direct intervals of two or three days, before extracting septic teeth, in lieu of preparing vaccine. Our patients frequently ask how long the influence of this vaccine will endure. To this question we have no answer. In my opinion, it will be beneficial to give a recurring dose at the end of three or four years, and as I have had the vaccine, I expect to carry out the schedule in my case.

TRAUMATIC OCCLUSION*

By BERNHARD GOTTLEIB, Vienna, Austria

HOW does traumatic occlusion originate? In studying this problem, we must first exclude all cases mutilated by extractions. We see in such cases too many expected anomalies. In many cases, the loss of only one or two teeth will be responsible for a deranged function of the whole denture. About this aspect of the problem, I shall not speak today. I shall also exclude all cases of obvious malocclusion. These irregularities are only too often responsible for traumatic occlusion. While such is the case, it may be misleading to regard such irregularities as the only cause of traumatic occlusion.

I wish to speak today only about those cases which have in the thirteenth year what what we call an ideal occlusion.

*Read before the American Academy of Periodontology, Philadelphia, Pa., Aug. 20, 1926.

How does traumatic occlusion originate in these cases? Here, we must bring to mind a detail from the biology of the teeth. After teeth reach the masticating level, between the sixth and thirteenth year, they do not cease their eruptive movement. They continue to erupt in various mouths at various rates. For this fact, we have clinical as well as histologic evidence. We find in adult mouths persistent deciduous teeth left behind after years by the neighboring permanent teeth. We see the same in the so-called "shortened" permanent teeth. The histologic evidence of this fact is provided by the fact that bundle bone is deposited at the base of the alveolus, and by the epithelial débris found in the bone channel occupied by nerves and vessels supplying the teeth some distance from their apices.

When the teeth thus continue to erupt from their alveoli, we must consider the possibilities for maintaining an equalized harmonious occlusion. This problem is complicated by the fact that the posterior teeth are nearer the axis provided by the mandibular joint than are the anterior teeth. It is inconceivable that the eruption of the teeth is so regulated that the farther toward the back of the mouth they are located, the slower their rate of eruption. Equalized occlusion is maintained in two other ways: on the one hand, by the depression of the teeth into their sockets, and on the other hand, by continued wearing down of the occusal surfaces in such a manner that an equalized occlusion is always maintained. Both types of regulation of the denture occur, but are only possible in dentures with firm teeth, in which the parts of the hard supporting structures, resorbed by the action of the forces named, are permanently restored. If such a restoration does not take place, a loosening of these teeth occurs and then neither depressing of the tooth into the jaw nor wearing down is possible. In such cases, the posterior teeth soon come into traumatic occlusion and become loosened, although their roots are larger than those of the anterior teeth. This type of loosening is well localized. When the loosening of the teeth in one jaw takes place at an earlier time than in the other, the teeth in the jaw not affected remain firm for a long time. There results from this the well-known type of case which shows in both jaws, or in one jaw only, the posterior teeth loose and the last remaining posterior teeth most impaired. This type of loosening occurs in cases in which the eruption of the teeth from the alveolus is physiologic and only the regulation of the occluding surfaces has failed of accomplishment.

The wearing down of the teeth is needful not only for the maintenance of balanced occlusion, but also because it provides for a constant and short length of the clinical crowns, whereby the extra-alveolar lever remains short, and is not lengthened by the continuation of eruption.

The failure to regulate the consequent physiologic eruption of the teeth is not the only source of traumatic occlusion. Every physiologic thing has its pathologic counterpart. The extrusion of the teeth out from the alveolus can proceed unevenly so that one tooth erupts faster than others. Such a tooth is already weakened by the causal factors in the accelerated eruption, and the resultant occlusal stress on this tooth does not force it back into its socket, nor does natural wearing down occur, because only a firm tooth can be worn

down. When an artificial wearing down by grinding does not take place, the loss of such a tooth is inevitable.

The physiologic wandering of the teeth is directed not only toward the occlusal line, but also toward the median line. For this statement, we have clinical as well as histologic evidence. The transformation of the approximal contact points into contact planes by wear makes the mesiodistal diameters of the teeth shorter. The maintenance of contact indicates that a wandering in the horizontal direction must take place. That it takes place toward the median line has been determined by analysis of the structure of the alveolar bone. For this physiologic wandering in the horizontal direction, we have also a pathologic counterpart; for instance, the isolated wandering of a central incisor labially, which every dentist has often seen. This pathologic wandering can occur in any direction except into the alveolus. When the horizontal wandering occurs in such a direction that traumatic occlusion does not develop, the wandering may cease and the loose tooth again become firm. When a tooth, through its horizontal wandering, comes into a relationship causing a traumatic occlusion, the tooth becomes looser and must finally fall out, unless the dentist gives sufficiently early relief by means of the carborundum stone.

The pathologic wandering indicates that the relationship between the tooth and the surrounding tissues is altered from the normal. We find, by histologic examination of wandering teeth, a resorption of the root surface, and when the wandering has stopped for a sufficient time before the removal of the tooth, we find these resorptions repaired by the deposition of new cementum.

The knowledge of these facts concerning the physiologic and pathologic wandering of the teeth forces on us the practice of controlling the dentures of our patients whether the natural regulation of the occlusal line happens in the manner outlined or not. In the latter case, we must help by grinding. From this point of view, we must prefer to restore occlusal surfaces by metal and not by porcelain. In metal surfaces, we can always see the areas of occlusal contact clearly. With these surfaces as a guide, we may conduct our grinding operations and will, under these conditions, obtain a better occlusion than by any effort we may make with the aid of carbon paper.

THE VULCANIZATION OF DENTURES WITHOUT POSITIVE MODELS*

By E. LETH-ESPENSEN, Copenhagen, Denmark

ON reviewing the Danish dental literature for several years back it will be observed that articles on rubber dentures have played but a moderate rôle in our dentistry, and have occupied little space in our dental publications. For years, we have heard discussions, as to whether bridgework should be fixed or removable, and a number of methods have been described for making gold inlays and gold crowns. The rubber denture was allowed to slip quietly into oblivion, and, to my opinion, very unjustly. Of course, every dental surgeon should be well trained in crown and bridgework, but only a few dental surgeons have a practice demanding the use of much gold and we all, more or less, are forced by circumstances to give our attention to rubber dentures. I am of the opinion that whether a patient is fitted with a gold crown, a bridge or a rubber denture, the dental surgeon should employ the same conscientious accuracy in doing the work, as only in this manner can we meet the requirements of the public. In other words, we should always place ourselves in the patient's position, and should never let the quality of our service be dependent on the cost. If I thus refer to this purely psychologic side of the problem, it is only due to the fact that the rubber denture is often spoken of as something of inferior class which one deals with only from force of circumstances. In Denmark, they are called "rubbers," "goloshes." The Germans also have a special name for them "caoutchoucbaking," etc. From a dental point of view, such an attitude is to be condemned. As regards the patient, it is just as good surgical art to make the prosthesis best suited in a special case, as to make an expensive gold bridge; for it should be remembered that the edentulous patient is in a far more unfortunate position, both cosmetically and as regards mastication than is the one who has lost only one or two individual teeth, which can be comparatively easily replaced with a bridge, if his economic status permits. Also socially, this question is of the greatest importance. Two years ago, I made a statistical calculation of the number of artificial teeth imported into Denmark, and was surprised to find that yearly about 1,300,000 artificial teeth are imported; which means the annual use of 2,600 teeth by each surgeon in Denmark or, more particularly calulated, the placing of a prosthesis of fourteen teeth every other day for each dental surgeon, all the year round. These figures should cause reflection.

There is a rather peculiar lack of interest in this problem. Dental laboratories have cropped up in recent years

*Read before the Section on Full Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

to which the construction of rubber dentures is often referred, and in these laboratories, the dental surgeon has no voice in the treatment of the denture. Everything is left to the dental mechanic and it will depend on good luck or accident whether the final result is scientifically the best possible, or perhaps the reverse, the worst possible. Where, for example, is there any control of the pouring flask, control of whether (1) the work is done with drain passages; (2) the denture is vulcanized in water or in steam; (3) the temperature is the proper one; (4) the duration of the vulcanizing is proper or (5) the rubber employed is of the proper kind, etc. In short, there is no control of all these details which determine the results.

I shall restrict myself to a few details which, perhaps, are not all known, and which I have met in my daily practice.

THE TAKING OF THE IMPRESSION

In making a prosthesis which will afford the patient the best service possible, the first condition is an exact impression. The impression should reproduce the parts of the jaw involved in making dentures. In accordance with the method by which the impression of the jaws is taken, anatomic and functional impressions, respectively, are spoken of. The former are employed in orthodontia, the latter in prosthetics.

The functional impression will reproduce that part of the jaw which, at a maximum function of all soft parts (tissues), is at rest. It should be considered indisputable that a correct functional impression is necessary before the work is further proceeded with. If an anatomic impression is used, the denture will surely be forced out of position by the movements of the muscles, owing to the edges being too high, and sores will result from pressure, or the denture will drop. A correctly made denture should thus fit well without being affected by the movement of the lips, the cheek or the tongue. The method for taking a functional impression differs according to the material employed. If plaster is used, the principal point to be considered is that the edges of the tray are not too high.

After the tray with the plaster has been moved into position, and before the plaster has set, either let the patient stiffen the muscles as much as possible; or assist the patient by pressing the lips and cheeks with the free hand, as far as possible away from the jaw. In taking a lower impression, it is important to let the patient raise his tongue upward or stretch it out over the tray. By this means, sores from pressure over the ligament of the tongue are avoided. I always employ this method with patients having a good, solid alveolar process. If the alveolar process is badly developed or atrophied, I employ the Fripp method of taking the impression with compound, which seems to be the ideal method in such cases.

I shall not speak further of Dr. Fripp's method but simply refer to his work: "Impression Taking and Denture Making."

POURING THE IMPRESSION

When the impression is finished, the model is poured. To facilitate the separation in plaster impressions, a thin solution of soap may be used, which will not affect the outline of the impression. In order to obtain as hard a model as possible, an attempt should not be made to accelerate the setting by artificial means, for example by adding chemicals such as common salt or alum. These

additions will cause the model to become brittle. It is also of great importance that the plaster be properly mixed, as a wrongly mixed plaster will expand considerably and may, thereby, be a source of faults which cannot be remedied at any subsequent stage. The greatest hardness of the model will be obtained by a medium thick mixture in which the plaster is strongly and quickly stirred, and which is poured immediately thereafter into the impression. By such means, the expansion is reduced to a minimum.

PREPARING AND TESTING THE WAX PLATE AND PLACING IN THE ARTICULATOR

When the plaster models are finished, the wax plates are made in the usual manner, and prepared and trimmed in the mouth, whereupon they are placed in the articulator. I shall not consider the articulator problem, as it still awaits solution. But I should like to dwell a little on Poul Wustrow's "drop method," which I have employed for about three years.

DROP METHOD (WUSTROW)

In the "drop method," rubber plates are made without using the plaster model in the articulator during the vulcanizing. After the models with the bite have been placed in the articulator, the wax plate on the model is replaced by another, which must fit in all detail into the model, as the second is used in the further procedure. The model is removed from the articulator and coated with paraffin oil in order to prevent the wax which, later on, is dripped on it sticking to the model. At the same time, for the upper model a piece of metal wire netting is cut and fitted, and, for the lower model, a piece of Barre wire, which shall serve to stiffen the wax plate while it is being tried in the mouth. While the model is still shining with the oil, the wax is dripped either with a wax spatula blade or with a special wax pen, onto the model and an attempt is made to form an even coat thin as paper over the whole. This dripping on of the wax should be performed rather quickly as otherwise the first drops of wax will harden before the next are dripped on. In this way, a thin coat of wax is obtained which reproduces the lines of the model, rugae, etc., including the smallest details exactly as in the pouring of gold plates. Now the previously adapted wire netting, or Barre wire, respectively, is fitted to the layer of wax, after being slightly warmed by passing twice through a gas flame. The clasps also are thus treated, if any are used. The dripping on of wax is continued until the desired thickness of the denture is attained. Then the model and plate are cooled under a cold water tap and the plate is carefully removed from the model and trimmed. With regard to the upper model, it will be easy, by holding it up against the light, to ascertain whether any should be removed or added in order to obtain the desired even thickness; and if the result is satisfactory, the fitting of the teeth may be proceded with in the usual manner, after the models with the new plates have been again placed in the articulator. Before the wax plate with the teeth is placed in the mouth for trial, it will be necessary to insure that it does not warp during the trial, and to cool it fully under cold water. The wax plates should never be tried too long at one time in the mouth as the temperature of the mouth will gradually soften it and blur the sharp outlines. In practice, I avoid this difficulty by letting the wax

plate remain in the mouth for a few minutes only at a time, thereafter cooling it again in cold water. Furthermore, I have adopted the practice of employing a thin baseplate of shellac instead of the wire netting recommended by Wustrow. It is placed over the first thin layer of wax dripped on and, in an excellent manner, protects the plate from warping. As this baseplate has the proper thickness, it insures, at the same time that the plate in the palate becomes uniform and neither too thick nor too thin, and thereby the danger of a subsequent fracture of the denture is greatly reduced. The shellac plate is put on with the help of a blowpipe and is trimmed while it is being fitted.

After the fitting of the wax plate with the teeth is finished, it is, by a slight pressure, attached to the model, and receives its last treatment with blowpipe and wax knife; whereupon it is ready for casting in the flask.

In order to secure a good result with this indirect method, we must be sure that the wax will neither contract nor expand, and, here we have the essential point which determines the applicability of the method. The common wax preparations in the trade are not intended for this purpose and therefore cannot be used. Professor Wustrow has, by experiment, found a wax compound which shows the desired properties, and he gives us the following formula:

	Grains
White beeswax	20
Refined turpentine	2
Sesame oil	1
Red lead	1

It goes without saying that a wax which contracts cannot be used, as it will cause faults to develop. However, no such fault will occur without its being detected, as the operator can control the model both before and after the vulcanizing.

POURING IN THE FLASK AND PACKING

When the wax plate has been cleaned and overhauled, it is poured in the flask as when a plaster model is employed, the wax plate first being filled with plaster and then lowered into the lower part of the flask while the plaster is still suitably soft. As in pouring the model, the plaster should not contain any salt, as this causes brittleness. Before the other half of the flask is poured with plaster, the surface of the wax is covered with a layer of tinfoil and the pouring of the flask is completed. When the plaster has set to the proper hardness (after twenty-five minutes), the flask may be heated and the wax melted out. A "Snow" outer passage and Gysi outlet passages are then cut, whereupon the rubber may be packed and pressed, and is ready for vulcanizing.

COMPLETING THE VULCANIZING

On the basis of my own experiments and experiences in practice, where, to a moderate extent, I have had the opportunity of ascertaining the advantages of Gysi's methods, I can recommend the following rules:

1. Use as hard a plaster as possible (without salt).
2. In order to avoid deformation owing to surplus while pressing, cut an outer passage (after Snow) in the flask.
3. Make one or two outlet passages (after Gysi) in order to avoid deformation owing to the expansion of the rubber.
4. Employ tinfoil for directing the contraction and retraction.
5. Use red rubber, with whole teeth on the lingual side of the denture and around the pins.

Use pink rubber, on the facial side of the denture and for fixing hollow teeth (molars and bicuspids).

Use black rubber for partial sets where strength is a main requirement owing to the high chewing pressure.

6. Warm the flask for ten minutes in boiling water before the pressing operation. This should be done slowly.

7. Too rapid vulcanizing will increase deformation and porosity.

8. Too slow vulcanizing will destroy the elasticity.

9. Employ the following in vulcanizing:

(a) A rapid rise to 130 Cels.; (b) forty minutes to rise from 130 to 160 and 165 Cels.; (c) vulcanization for one hour and fifteen minutes. (d) a delay until the manometer stands at 0 before the flask is taken out.

10. Always vulcanize in steam.

11. Let the flask cool slowly so as to reduce the consequences of contraction.

12. Polish the denture without using pressure and without producing heat, in order to avoid all deformation owing to the latent contractions.

FITTING THE PLATE IN THE ARTICULATOR

When the vulcanizing has been finished and the flask has been thoroughly cooled, the plate is taken out of the plaster, cleaned and finished. As the plaster models are still in the articulator, the finishing work may be carried out with aid of these models. Anyone can see the advantages derived thereby. The edges may be filed accurately, and with partial plates the filing around the individual teeth can be done exactly.

After the dentures have been finished and polished, they are fitted in the articulator in exactly the same position as before the wax was removed. Whether the teeth have been displaced at all can then be easily ascertained and correction made in the laboratory. By the aid of a piece of blue articulating paper, an accurate occlusion and articulation may be produced.

By using this indirect method, a constant, exact control of the work is obtained, and sources of faults are more easily found and, if necessary, corrected just as in gold plates if the finished work is delivered from the laboratory in the articulator.

This will do away with the disagreeable uncertainty which is known to all practitioners, when a plate is given to the patient, as plates made in this manner will not require fitting or grinding in the mouth.

It will suffice merely to indicate how great an economic advantage would accrue from transferring all fitting work from the clinic to the laboratory. I might also mention the importance which the method has for dental surgeons who send out their work to different dental laboratories. If the impressions and the models, which of course in all instances should be taken by the surgeon, are correct, all the remaining work is transferred to the laboratory. The dental surgeons only work is then to put the denture into its place, or to send it by mail, for it will be sure to fit.

Notwithstanding the progress of recent years, the problem of rubber work has not yet been satisfactorily solved. The road is still open to improvement and study. In view of the great social importance of the question, it should be our duty to place brick upon brick until the object is reached. Only thus shall we attain satisfaction and merit the gratitude of our patients.

SPECIAL FEATURES IN THE TREATMENT OF ACUTE SURFACE INFECTIONS OF THE MOUTH*

By ARNOTT A. MOORE, D.D.S., Buffalo, New York

THE treatment of acute surface infections of the mouth should be both local and general. The latter should be in charge of a competent physician and should include general therapeutic measures such as complete rest, correct diet and attention to the bowels. As a general rule, the diet should be soft and should not contain large amounts of raw fruits or uncooked starches. In the case of saprophytic infections, it is well to leave proteins out of the diet as much as possible. Complications of a general nature must be met by the physician as they arise.

Gentleness should be the keynote of the local treatment, and therefore the tissues should not be disturbed any more than is absolutely necessary. In cleaning the mouth and teeth, cotton swabs should be used rather than a toothbrush, trauma incident to prophylaxis being thus minimized. Inasmuch as tissues may be injured chemically as well as mechanically, the choice of the antiseptic to be used is of great importance. Many antiseptics are injurious to body tissues, and thus must be avoided. The antiseptic must kill or interfere with the growth of bacteria and must not coagulate albumin or interfere with phagocytosis. Preferably, it should be water-soluble and of such a nature that it will not be decomposed in the presence of serum or of the débris found in acute infections. An antiseptic having been chosen that meets these requirements, application to the affected parts should be made with the utmost gentleness while the infection is acute. Sloughs should not be disturbed nor should the swollen or irritated tissues. The use of swabs or applicators is recommended at this stage; whereas, later in the course of the disease, the antiseptic may be injected into pockets and under the free margin of the gums by means of syringes with blunt-pointed needles.

The most common, and probably the most important, of the acute surface infections with which we have to contend is Vincent's, sometimes called trench mouth.

The antiseptics recommended are acriviolet, arsphenamin in glycerin and a weak solution of ammonium fluorid. Any of these are gently applied by means of swabs while the infection is acute. I use acriviolet in a 1 per cent solution twice daily until the acute symptoms and sloughing have subsided; then alternate occasionally with the arsphenamin in glycerin, or the ammonium fluorid solution, as bacteria are apt to become immune to antiseptics if

*Read before the American Society of Oral Surgeons and Exodontists, Philadelphia, Pa., Aug. 20, 1926.

*The discussion of the papers of Drs. Moore, Blue and Bogle will be found on page 1289.

they are used continuously. The mouth wash is of great importance, a 1:5,000 solution of mercuric chlorid in hydrogen peroxid, or a saturated solution of sodium bicarbonate being recommended. During the acute stages, the teeth should not be cleaned by the patient as every time a hemorrhage is produced there is more pabulum for bacterial growth. After the acute stage is passed, a 0.5 to 1 per cent solution of tannic acid in alcohol acts as an efficient astringent and tonic. For tissues that have been infected, the general treatment as outlined should be used, with the exception that aluminum subacetate compresses (2 to 4 per cent) reduce glandular symptoms to a marked degree.

Infecting organisms in an acute streptococcus infection may be of the hemolytic or nonhemolytic type. If it is of the former, it is well to use hot mouth washes and apply the antiseptic being used only once daily for the first three or four days. In the case of infection by a nonhemolytic streptococcus, hot washes are of no particular value, and the antiseptic should be applied as often as is practical. In either type of streptococcus infection, the following dyes are recommended: acriviolet, 1 per cent; neutral acriflavin, 1:1,000; mercurochrome, 2 per cent. It is well to apply them under the free margin of the gums with a syringe and blunt needle and also to all the soft tissues of the mouth and throat. General symptoms should be treated as they arise. While the infection is acute, operation is to be avoided if at all possible.

The mixed infections are many and varied. Briefly, their course may be rapid or slow, depending on the type and virulence of the infecting organisms and how well they grow together. Mixed infections of a rapidly progressive type require constant attention. Complications should be expected and serious attention should be given to the slightest indicative symptoms in order to forestall them if possible. An efficient antiseptic, such as acriviolet or mercurochrome, should be applied at least twice daily, and, whenever possible, a specific for the predominating organism should be incorporated into the mouth wash.

The local treatment in the case of an acute pneumococcus infection consists of applications of quinine sulphate (a specific for pneumococcus) to the tissues involved, with swabs and syringes, alternating every other day with acriviolet. In pneumococcus infections, the hydrogen peroxid-mercuric chlorid formula is recommended. Neck symptoms in this type of case are unusual.

Acute saprophytic surface infections of the mouth are rather rare. In their treatment, it is best to use a mild mouth wash as the vitality of the tissues is low and strong drugs are liable to produce more sloughing. The official antiseptic alkaline solution is recommended, it being mildly antiseptic and harmless to tissues. A 10 per cent solution of ichthyol daily, alternated with a 1 per cent solution of acriviolet, produces good results. There should be no operating under any circumstances during the acute stage of a saprophytic infection.

The complications that may follow in the wake of these surface infections of the mouth may be divided into local and general. Locally, there may be large sloughs and sequestration; death of pulp and subsequent abscesses, and such excessive swelling that breathing is

made difficult. General or distant complications may be: 1. Metatasis; for example, to the ear through the blood stream, to the lung through inhalation, and to the intestine through swallowing bacteria. 2. Sinusitis, usually in the antrum. 3. Throat conditions, such as tonsillitis or pharyngitis. 4. Neck conditions, involving the submaxillary sublingual glands, the cervical nodes or the areolar tissue. If any of these general or distant complications arise, they should be cared for in conjunction and with the aid of a competent physician. Too much stress cannot be laid on this last statement, as some of these cases will end fatally in spite of the most careful and scientific treatment.

The treatment of the local complications in acute surface infections of the mouth is important. Large sloughs should not be disturbed as they act as protective covering to the deeper tissues. The same applies to sequestra until they have become thoroughly loosened and can be removed without any great disturbance of the remaining tissues. The antiseptic used should be very mild and slightly stimulating. One of this type is balsam of Peru, which can be used daily in addition to the regular treatment.

If death of the pulp occurs, the teeth should be opened and treated as though they were to be retained. Abscessed teeth should be handled in the most conservative manner, the use of local heat being recommended rather than the knife. Local heat should be applied to the gums directly over the affected tooth and not to the outside of the face. Raisins or figs heated in milk make an efficient mouth poultice.

Excessive swelling is rather difficult to control. Hot mouth washes are the best local remedy. If the swelling extends into the cervical region, compresses of aluminum subacetate will be found of great value.

As previously stated, operative procedure should be resorted to only in case of direst necessity, after all other possibilities and means of avoiding it have been exhausted. In cases of saprophytic infection, there should be no operating under any circumstances because of the inability of a blood clot to organize in the presence of an acute saprophytic infection and because of the danger of serious sloughing. Operative procedure, if necessitated, should be as conservative as possible. The wound should be given free drainage and should be treated as the rest of the mouth. One point to be remembered is that no oxidizing agent should be used in the mouth while there is an open operative wound. Therefore, if the hydrogen-peroxid-mercuric chlorid mouth wash is being used, change should be made temporarily to any other mild wash, such as the antiseptic alkaline solution (U.S.P.) or compound solution of sodium borate (Dobell's solution).

The acute surface infections of the mouth are of the utmost seriousness, as shown by the local and general reactions that they produce. The treatment is somewhat the same for acute as for chronic infections, except that the acute cases should be handled with extreme gentleness, and the patient should be given complete rest and constant attention. Antiseptics should be used that do not coagulate albumin, kill tissue or interfere with phagocytosis. Complications should be met as they arise, and consultation called for when necessary. One should be very reluctant to operate, and, if forced to, should be as conservative as possible.

40 North Street.

SPECIAL FEATURES IN THE TREATMENT OF MANDIBULAR FRACTURES*

By J. A. BLUE, D.D.S., F.A.C.D., Birmingham, Alabama

FRACTURES of the mandible are liable to occur in any part of the bone, but are most common at or near the mental foramen and the angle. Diagnosis of fracture of the mandible is a simple procedure, owing to the efficiency of the roentgen ray. Extra-oral roentgen ray examinations should be made of all cases of suspected fracture of the mandible. This procedure precludes the possibility of injury to the affected parts, as manipulation is reduced to the minimum. Probably, the best and most commonly used method of treating mandibular fracture is to wire the teeth into occlusion. According to the method advocated by Gilmer, I have used a 26 gage angle wire doubled. These wires are passed around the necks of the first molar and second bicuspid, upper and lower, and twisted so that they will remain firmly in place. Then the free ends of the wires of the upper molar are twisted with the free ends of the wires attached to the lower second bicuspid. This produces a pressure that draws the mandible distally and the teeth into proper occlusion; then, the free ends of the wires of the lower molar are twisted with the wires on the upper second bicuspid. This holds the mandible in proper alinement.

If the fracture is located adjacent to the teeth mentioned, it will be necessary to attach the wires to other teeth, as it is never advisable to wire teeth in the line or adjacent to the line of the fracture. In some cases of fracture, it is very difficult to bring the teeth into occlusion. For instance, a case is recalled in which a mandible was fractured through the lateral region on the right side and the neck of the condyle on the left side.

The action of the muscles of the left side had drawn the mandible upward and produced lapping of the bones. In this case, a wood block (one-fourth inch thick) was wired to the occlusal surface of the lower second molar, this block acting as a fulcrum on the left, while the teeth on the right were wired as nearly into occlusion as possible, but even this did not entirely overcome the muscle contraction. As there remained a slight lap of the bones of the condyle neck, the wires were allowed to remain six weeks. After removal of the wires, the teeth were found to be in good occlusion.

Mandibular fractures of children, that is, mere babies with only temporary teeth, afford a serious problem, which has been solved somewhat by anesthetizing the child with ether, and placing the teeth in normal occlusion, at the same time reducing the fracture. While the mandible is held in proper relation, modeling compound is molded to the jaw, extending under the chin and to the angle on both sides. This affords

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a firm splint. This splint is padded with gauze and put in position, and a gauze bandage is wrapped around the modeling compound and extended around the head as a Barton bandage, this gauze being used to protect the skin and hair. This is followed by a 2 inch adhesive strip, which is used as is a Barton bandage. The adhesive strips hold the splints in position and the teeth in occlusion and will not be removed by the child. This method admits a slight movement of the mandible, which is not objectionable.

SPECIAL FEATURES IN THE TREATMENT OF MAXILLARY SINUS INFECTION*

By R. BOYD BOGLE, D.D.S., Nashville, Tennessee

IN maxillary sinusitis, each case presents its own problem. It is always well to know the immediate cause of the infection, but, in many cases, this problem is unsolved and we are faced with the fact that a sinusitis exists.

In the acute form, it is often found that warm bland alkaline irrigation of the nasal passage with hot moist compresses over the cheek will aid in establishing drainage through normal channels. This form is frequently accompanied by an acute cold and the infection is of nasal origin. Relief is often obtained by a puncture of the naso-antral wall with a trocar, followed by irrigation.

When sinusitis exists, transillumination and radiographic examinations are indicated. It is to be regretted that these do not always give us the desired diagnostic aid.

Before complete engorgement occurs, the patient may have much pain and inconvenience, which may not be revealed by either of the foregoing diagnostic measures. The presence of pus in the middle meatus aids in the diagnosis. Its absence is not a positive sign.

Puncture of the naso-antral wall and irrigation may be employed when doubt exists as to the presence or absence of the condition. Clinical and radiographic examination of the teeth and sinuses are essential. It is claimed by some writers that the origin of infection of the maxillary sinus is traceable in a large percentage of cases to the teeth. The relative percentage is still a matter of doubt, as no accurate reports have as yet been tabulated.

If clinical and radiographic findings indicate a dental origin, elimination of the infection from this source should be instituted. It does not follow that drainage should be established through an opening in the maxillary bone through the sockets of the infected tooth or teeth.

Pyogenic organisms found in the sinus do not thrive where there is plenty of air and ventilation. This condition is not best obtained by drainage into the mouth for the following reasons: 1. It is not the normal route. 2. There

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is a lack of proper ventilation. 3. There is danger of contamination of the sinus with the mouth flora. 4. Foods and liquids taken into the mouth gain entrance to the sinus, and there is a lack of drainage through the opening and difficulty in closing the opening in many cases.

Often when the patient is considered as nearly well and the operator hopes for a closure, unless an opening has been established through the naso-antral wall, the case often assumes the annoying chronic form, with all its discomfort to the patient, and the continued attempt of the operator to effect a cure is unsuccessful.

In cases of polypi, the nasal operation does not always afford sufficient access to the sinus, and the opening through the canine fossa is often necessary for access and observation.

There is a need for better cooperation with the nose and throat specialist in the diagnosis and treatment of cases of maxillary sinusitis. Associated infections of the other sinus, nasal obstructions and other cases of nasal origin must be taken into consideration; and, for these reasons, consultation is not only advisable but also very desirable.

For diagnostic purposes, the point of preference for insertion of the trocar is through the naso-antral wall. When the sinus is infected from dental origin, closure of the wound and establishment of nasal drainage are preferable.

When a sinus has been drained and does not clear up after a few weeks of occasional irrigation, a permanent opening (not too large) should be made. When this opening reveals the presence of polyps, better access can be obtained from approach through the canine fossa. The general health of the patient should not be overlooked.

DISCUSSION

Theodor Blum, New York City: The fact that most cases of maxillary sinusitis are of nasal origin explains why the oral surgeon is comparatively seldom called on to take care of them. Only those cases that originate from diseases of the teeth or maxillae belong to the field of the oral surgeon. The acute dental cases respond to treatment quickly, as do the chronic dental cases when compared to those of nasal origin. The removal of the offending tooth, or the amputation of its apex after the root canals have been properly treated, and irrigations of the antrum with warm saline solution will suffice in most instances. Where there is a marked change in the antral membrane, an opening sufficient to permit thorough inspection of the maxillary sinus will have to be made through the canine fossa or somewhere above the apices, to remove hypergranulations, polypoid tissue or mucous cysts. Practically never is there an indication for the entire removal of the antral mucous membrane. In his vast experience, Hajek has never found it necessary to do so. Badly diseased islands of membrane are entirely removed here or there, while the remaining mucous membrane plays an important rôle in relining and recovering the exposed bone with epithelium. Sinusitis at times is a complication of an osteomyelitis of the maxilla. The treatment of the osteomyelitis will be followed by the disappearance of the sinus infection. Many chronic antrum cases, admittedly of probable dental origin, are better taken care of by the rhinologist when the original dental cause has been eliminated some time previously.

THREE VITAL QUESTIONS IN DENTISTRY*

By N. G. PAPANTONOPULOS, M.D., D.D.S., Sc.D., Athens, Greece

IN dentistry, just as in other branches of biology, there are many questions to be answered. Some of them are important and require the immediate answer, some are not so important, and can be answered later on without much disadvantage to the respective branches they concern.

In dentistry, we have three questions that are of paramount importance to our science and that have to be answered by this congress of the most intelligent dental scientists of the world.

In other words, we have to put the seal of our approval or disapproval on the different methods that are in use all over the world, and give to the members of our profession something definite, if we can do so, or something that is nearest to definite.

ROOT CANAL FILLING

First is the question of root canal filling. This question, the cornerstone of dental therapeutics, must be answered and, in the plainest way, must be shown the way to success.

I will not take the time to review the different methods that are now in use. We are all familiar with them. Neither will I go into detail as to the technic.

My clinical experience teaches me that root canals must be filled with some plastic material that will soon solidify. They must be filled to the apex and not above or beyond this. This filling of the root canals does not amount to anything, if we fail to preserve, during all the progress of our work, the most absolute asepsis. The filling material does not play any important rôle, as long as it is plastic and solidifies in a comparatively short time. I use chlorapercha and guttapercha cones for the root canals of the healthy pulps as well as for the gangrenous, too.

This question is vital, because the profession now has so many opinions about it. Some think the root canals do not have to be filled at all; others, that they can be filled in any way; and still others that they must be filled to the apex and not beyond or above this, as I do; and so on.

PRESERVATION OF THE LIFE OF THE PULP

Next comes the question of the preservation of the life of the pulp. This question has to be considered in its two important phases: 1. Are we to extirpate the pulp in cavities well advanced and nearing the pulp? 2. What is the best thing to do when we use sound teeth as abutments in bridge work. Are we supposed to take the pulp out of the sound teeth or not?

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For my part, I do everything within my power to preserve the life of the pulp, no matter how much caries is present and no matter what the possibilities for success are. Of course, microorganisms may have entered through the dentinal tubules; but this is not always the case, and we never can tell when it may happen. So it is best to endeavor to conserve the pulp, and if trouble develops later on, that is time enough to meet the situation. What I generally do is this: (1) adhere to rules of asepsis; (2) line the cavity with an antiseptic lining; (3) fill the cavity temporarily with some nonirritating cement, and six months later, if everything goes well, place the permanent filling.

When vital teeth are used for abutments, I follow, as a rule, the conservative method. I grind the teeth down as much as I can, and, when I come to the sensitive part, I inject down to the apex of each tooth 2 c.c of procain and complete my grinding to the desired point. It is not necessary to complete the work on both teeth at one sitting.

There are, of course, some objections to this method, but if we take into consideration all the pros and cons, we shall agree that it is best to conserve the life of the pulp in the vital teeth as long as we can, and, if any untoward effects develop later on, meet the situation accordingly.

LOCAL INFECTION FROM PULPLESS TEETH

Next comes the question of gangrenous teeth and focal infections. This question has been studied from every angle, in recent literature, so there remains nothing to be said. I divide all gangrenous teeth into two classes: (1) those with periapical infection, that are as a rule tender to percussion, and (2) those with no apparent periapical infection; in other words, those with acute and those with chronic disease of the pulp.

In both instances, I employ the following technic: 1. A radiogram is taken in order to determine whether the periapical area is rarefied or not and the extent of such an area, if present. 2. If the infected area is comparatively small, I treat the tooth in the usual way, fill the root canals properly and fill the tooth temporarily. From three to six months later, I take a second radiogram and compare it with the first one. If the indications are favorable, I fill the tooth permanently. If not, I class it in the second category, and proceed as already detailed up to the filling of the root canals. After this is done, I inject 2 c.c. of procain to the apex, and make an opening and curet the area thoroughly. I then wash it with saline solution, pack it with aseptic gauze, continuing this treatment for two or three sittings. Two or three months later, I take a radiogram and compare it with the first taken. The chances are that 90 per cent of the teeth so treated give no more trouble.

As a rule, I never use infected teeth for abutments unless I know that the tooth has been treated as described and with favorable results.

As far as the advanced cases and those with abscesses are concerned, a surprising percentage of these heal if treated as outlined above. In one word, I adhere to the conservative method, and I am, so far, satisfied with the results.

GOLD AND ITS ALLOYS FOR INLAYS*

By F. V. SIMONTON, D.D.S., and JOHN S. SHELL, B.S.,
San Francisco, California

THE selection of casting metals for inlays should be determined by the purpose for which they are placed and by their position and form. We may distinguish two general classes: those designed for bridge abutments and those constructed for restoration of single teeth. The latter will include simple and complicated inlays and certain special types to suit peculiar conditions and particular purposes.

Inlays for Bridge Abutments.—The metal chosen for this purpose should be especially resistant to tensile and compressive stress, to prevent either stretching or bending. It should tolerate being repeatedly subjected to high temperatures and be well adapted to soldering. Since bridges usually are required to effect adjustments of occlusion, they must resist attrition. Inlays designed to support stress breakers should possess great compressive strength. Those of the partial veneer type must exhibit marked edge strength.

Inlays for Individual Teeth.—The requirements for metals used in inlays in individual teeth will be as follows: (1) clean alloys; (2) accurate casting; (3) tensile and compressive strength; (4) edge strength; (5) resistance to attrition; (6) freedom from staining or discoloration; (7) satisfactory color.

Inlays for cavities in the proximal surfaces of anterior teeth and in the gingival thirds of teeth require but little mechanical strength. Those for the latter should be fairly resistant to attrition to prevent flattening of their surfaces through brushing.

Occlusal inlays must resist attrition to a high degree and must possess marked edge strength.

Inlays for proximal surfaces in posterior teeth, and those for the proximal surfaces of anterior teeth in which the incisal angle is restored, should have much tensile and compressive strength, together with edge strength and resistance to attrition.

Mesioclusodistal inlays in bicuspids require special consideration. In these, the occlusal element is frequently narrow and thin and the proximal flanges relatively massive. Distortion by bending or stretching of the occlusal portion must be guarded against.

Inlays are not infrequently constructed when the anatomy of the particular tooth and the form of the caries makes it difficult or impossible to secure anchorage by the usual means. In these cases, retention may be gained by the use of spurs or pins. By spurs, we mean narrow, rectangular extensions of the cavity in strategic locations where

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they may be laid in tissue of adequate strength and at the same time in immune territory. Into these will fit corresponding extensions of the inlay planned with such a relation to the resultant of the stresses as to retain the inlay. These spurs are of necessity limited in bulk, and hence must be very strong, so as not to bend, stretch or break.

If it is thought necessary, rectangular pieces of post wire may be fitted to the extensions in the cavity and embodied in the casting.

The use of pin inlays is sometimes necessary. Pins may be cast on so as to unite them to the body of the inlay, in which case provision should be made for successful union of the pin with the casting metal. Pins may also be cemented to position in the cavity, and the inlay in turn cemented to them, or the inlay may be placed first and a hole drilled obliquely through the inlay into the tooth substance and a pin fitted and cemented to place.

Finally, inlays may be designed for special purposes: 1. To raise or stay the bite. This requires great resistance to attrition. 2. To restore fractured anterior teeth. Here, strength and rigidity together with marked edge strength are necessary. 3. To carry silicate, or porcelain veneers. These should usually be employed with inlays restoring fractured anterior teeth. 4. For esthetic purposes. There will be occasional positions in the anterior regions of certain mouths where a very light colored alloy will be inconspicuous. The color will then be a primary consideration.

Alloys.—Pure gold casts well and is readily burnished, but, though denser than foil, has less resistance to attrition because foil is hardened by malleting. Pure gold is suitable for gingival third cavities in the proximal surfaces of anterior teeth not involving the restoration of the incisal angle.

Copper imparts hardness, primarily, to gold alloys, together with a corresponding increase in tensile strength and other similar physical properties. With greater copper content, the color is less desirable, and occasion for the formation of copper oxid is increased. These oxids are probably not harmful unless of considerable size and located at disadvantageous positions in the casting, such as a margin or across a narrow neck that is subject to some bending force. The copper content is also an important factor, if not the deciding factor, in the effectiveness of heat treatment on a gold alloy. The addition of copper also lowers the melting point of the alloy; pure gold melting at 1064 C. and 19 carat gold copper alloy below 900 C. This lowering of the melting point should be considered when choosing a solder for alloys of high copper content.

Silver affects the color of gold, but toward the opposite end of the spectrum from copper. The two can be used together advantageously, maintaining a color closely resembling pure gold, or almost any variety of color to meet the individual taste. Silver has only a slight effect on the hardness and other physical properties and causes only a negligible lowering of the melting point when used alone with gold. The ternary alloys of gold, silver and copper are often used in inlay work, with varying percentages of copper and silver to give sufficient hardness, at the same time maintaining a more suitable color than that of the binary alloy with copper.

Platinum alone has little effect on hardness, probably increasing tensile strength slightly, but an alloy of gold and platinum alone is of little value.[1] Platinum also raises the melting point so that an alloy containing only gold and platinum cannot be melted with a gas and air blowpipe if it contains more than 8 or 10 per cent platinum. The cost is also increased appreciably, but this may be offset by the possibility that platinum affords of increasing the base metal content. One of the most important advantages in the use of platinum is the opportunity to form alloys with a greater percentage of base metal. An alloy containing from 10 to 15 per cent of copper with gold would oxidize rapidly during casting; whereas, if a small per cent of platinum is added, the alloy casts more smoothly and the harmful effects of such an amount of copper are overcome. By this means, a large percentage of copper can be added, hard alloys which also have the property of resiliency and increased tensile strength being thus produced. Nickel has been added to some alloys, but, so far, has not been used extensively. It modifies the color, making it lighter, so that with from 10 to 15 per cent of nickel, a white gold is produced. Its advantages and disadvantages have not yet been fully demonstrated.

Alloys must be clean. Contaminants may be of three kinds: foreign metals, metallic oxids, and extraneous materials such as silica and graphite from the investment and gases occluded from the flame during casting or in the preparation of the alloy. Alloys containing impurities of the last two types may be purified sufficiently to insure suitable material for casting by the proper use of fluxes. Silica and occluded gases and other extraneous materials may be removed by melting the metal in a clay crucible under a flux of molten borax, removing the metal before the borax solidifies and quenching in water or dilute acid. Metal oxids may be removed to a great extent by melting under powdered charcoal and quenching in dilute acid after solidification. Impurities of the first class may be partially removed by the use of an oxidizing flux such as potassium nitrate, but the composition of the alloy is altered and complete removal of the base metal is almost impossible. This procedure is seldom advisable.

Alloys should not stain or tarnish in the mouth. Tarnishing is due to low carat alloys, and can almost always be avoided by the use of high grade alloys. No definite minimum carat can be designated, although ammonium sulphid, the most prevalent as well as the most reactive tarnishing agent in the mouth, does not attack copper alloys containing more than from 50 to 55 per cent gold.[2] This is assuming the absence of metals other than high carat gold alloys, such as amalgam, in close proximity. It is possible that, under these conditions, especially in a poorly alloyed amalgam containing a slight excess of mercury, a reaction between the gold and the mercury could take place. Coating of the alloy with a thin veneer of mercury would soon discolor it. Alloys containing a large number of pits due to imperfect casting might be stained through the filling of these pits with débris from the mouth.

1. Binary alloys of gold and platinum are not used in dentistry. They would be almost as soft as a gold silver alloy.

2. Tammam: Text Book of Metallography, Chemical Catalog Co., p. 140.

Shrinkage and expansion are negligible in all clean alloys used in casting, if proper technic is employed. Discrepancies attributed to shrinkage are often due to faulty manipulative procedures.

Alloy for Inlays for Bridge Abutment.—Bridge abutment inlays should withstand repeated subjections to high temperatures. An alloy suitable for this and the other considerations previously enumerated should contain a small amount of silver, about from 8 to 10 per cent of copper, and 5 per cent of platinum.

Alloys for Inlays for Individual Teeth.—In casting proximal inlays for posterior teeth, proximal inlays restoring the angle of anterior teeth, occlusal and mesioclusodistal inlays and partial veneers, a 21 to 22 carat copper-silver-gold alloy containing about three times as much copper as silver is suitable.

For spur inlays, copper should be added to the gold to give tensile, compressive, bending and edge strength. In the series of gold-copper alloys, some will be found to supply practically all of these properties, and, with the addition of silver as a color modifier, those various ternary alloys are used. In most cases in which extreme strength is required and larger amounts of copper are employed, some platinum should be added to reduce oxidation and increase the melting point for subsequent soldering operations. This is especially important where great edge strength is demanded, since copper alloys are often brittle, particularly after being reheated a number of times, as may occur in soldering.

For casting against pins, the temperature of casting is an important factor. The pin being colder than the molten metal and a good conductor of heat causes the metal to chill rapidly on casting and often causes it to solidify before reaching all the extremities of the mold. Perfect union of the pin and the casting may also fail to take place. The alloy, therefore, should be heated to a slightly higher temperature when casting against a pin. Flowing a slight amount of solder over the end of the pin to be embedded in the casting is also a good method of securing better union.

For restoring fractured anterior teeth, and to carry silicate or porcelain veneers, a medium copper, high platinum and low silver alloy is indicated. This will give sufficient edge and tensile strength and, at the same time, medium hardness.

For raising the bite, an alloy containing as high as from 15 to 20 per cent copper may be used, with 4 or 5 per cent silver and possibly a small percentage of platinum.

When a light colored gold is desired for esthetic reasons, a high platinum alloy containing a little silver can be used. The white golds employed in jewelry have not been employed to any great extent in dentistry, but might be used in such cases.

Heat Treatment for Hardening.—In special cases in which extreme hardness is demanded and some burnishing or swaging must be done after casting, it is possible to prepare the alloy of high copper content in a soft condition by cooling rapidly from the melting point. This procedure forms a more malleable alloy than when slowly cooled. After the mechanical work has been done on the soft alloy, it can be hardened by heat treatment before final cementation in the cavity. This can be done by heating to a dull red heat and cooling

slowly, maintaining a temperature just below red heat for one half hour or longer. This temperature should correspond to about 380 C. or about 700 F.

It seems possible, by combining the four metals, gold, silver, copper and platinum, with the occasional use of nickel, in connection with the ability to modify the properties of the alloys by heat treatment, to produce an alloy suitable for almost any requirement in inlays. For the average inlay work, alloys of gold, silver and copper should be thoroughly satisfactory in respect to color, hardness and strength. It is occasionally necessary to add platinum for such special cases as have been mentioned.

DISCUSSION

A. R. McDowell, San Francisco, Calif.: Beyond a doubt, the majority of dentists employing alloys in their practices give little or no thought to the metallurgic properies of the metals used. Dr. Simonton and Professor Shell emphasize, in their introduction, that "the selection of casting metals for inlays should be determined by the purpose for which they are placed and by their position and form." While the wisdom of this statement is obvious, there are so many different casting golds on the market today, each trying to solve some particular phase of cast gold work, that the situation may be somewhat complex to the average dentist unless he has made a study of the commercial alloys on the open market for casting purposes. This can be obviated by noting the results obtained from a series of castings using alloys of known formula. Dr. Simonton and Professor Shell have divided this interesting subject into five natural subdivisions as to where inlay castings are indicated; e.g., bridge abutments; restoration of individual teeth; opening the bite; restoring of fractured anterior teeth and occasional positions in the anterior region of certain mouths where esthetics are to be considered, inlays to carry silicate or porcelain veneers, together with the reference to the alloy indicated in each instance and a general consideration of alloys, with their conclusions. That gold in its pure state has but a limited use in dental castings is a well known fact, and in order to increase its hardness, tenacity and durability, it is necessary to alloy it with other various metals as may be required for the purposes employed. As here pointed out, the metals in general use for this purpose are copper, silver and platinum, and mention has ben made as to how each of these metals affects the alloy. The merits and demerits of each metal in an alloy has been clearly shown in this interesting paper. It is the behavior of each metal used in an alloy that holds the attention of the metallurgist, because a very complex phenomenon takes place when metals are brought together in a state of fusion. The older views on the subject according to Matthiessen, were that the resulting alloy was either a solution of one metal in another; a chemical compound; a mechanical mixture or a solidified solution, or a mechanical mixture of two or all of the before mentioned substances. Our present concept of alloys, according to Brady, is that alloys may consist of similar crystals of one metal; mixed crystals of different metals; chamical compounds of different metals; eutectics of different metals, or mixtures of those just named. Alloys are designated by the number of metals entering into their composition as binary, ternary, quarternary, etc. It is stated by Weinstein that "it is generally accepted by metallurgists that binary alloys of gold and silver, copper, platinum, or palladium, form solid solutions, that is, solutions of one metal in another, if in proportions within certain limits." In this category is found coin gold, at one time largely used for dental castings, composed of nine parts gold and one part copper.

Max Wassman, San Francisco, Calif.: We can all remember when pure gold was used for all our inlays, and today it has been suggested that it be used in one place only, in Class III cavities. So the question to decide is what alloy should be used. It seems to be generally conceded by all the authorities that copper, silver and platinum are the important metals with which to alloy our pure gold for our inlays. Our discussion today has to do with inlays alone, the conclusion being that these metals, together with nickel perhaps, are all that we need. The important question is how the

average practitioner is going to obtain these alloys. We do not know the formula of any of the alloys that we buy from the manufacturers. We are merely told, for example, that "these alloys contain a considerable percentage of alloying elements (platinum, palladium, copper, silver)."[3] That is not very enlightening as to what we are using. The profession should demand exact details as to the formulas of the alloys that it is invited to use. Few dentists, if any, would alloy their own gold, but they should have definite information on the subject. The only alloy of which we have definite information is coin gold. The United States coin gold contains 900 parts of pure gold and 100 parts of copper. The gold coins of France, Germany, Belgium, Italy, Switzerland, Spain, Greece, China and the "crowns" of Austria are all made by this same formula. The gold coin of Great Britain contains 916 parts of pure gold and 84 parts of copper. United States coin gold casts beautifully and, in my practice, answers all requirements for an inlay gold. If the copper content were increased to 15 or more per cent, there is no doubt that there would be trouble with oxidizing, but this trouble is absent in the standard coin gold. The color of the coin gold can be modified by the addition of silver as suggested, and this seems to be the only use for silver in the alloy. At the present time, the profession in the United States is being advised that an alloy with nickel is going to solve all our troubles and problems. As was here stated, the advantages and disadvantages of this alloy have not as yet been fully demonstrated. Drs. Simonton and Shell speak with authority, for it is their work to investigate these things constantly and they are far more qualified to judge them than the average general practitioner. Alloys must be clean. This to my mind is of great importance, and we should always clean a button if it has been used before. As is here stated, we should not use potassium nitrate, because the composition of the alloy is altered and complete removal of the base metal is almost impossible. I must confess that I use potassium nitrate to clean my buttons of alloy. "Potassium nitrate is an exceedingly useful flux in the purification of noble metals," says Turner. "When used as a flux and heated, it energetically gives up a portion of its oxygen to base metals, which are thus oxidized, and the alkaline nitrate becomes a nitrate."[4] I melt the button to be cleaned on a charcoal block, using considerable powdered borax. When it is well melted, I add some powdered potassium nitrate, then some more borax. As soon as the button solidifies, I drop it into the pickling dish, using either dilute sulphuric, nitric or hydrochloric acid. I always find my castings better after the alloy is thus treated than they are if I neglect this simple operation. I am interested to note the statement that shrinkage and expansion or negligible in all clean alloys if proper technic is employed. Ever since the fad of making complicated cast clasp bridges cast all in one piece came into vogue, I have felt that shrinkage and expansion were of little importance to us; for many of the complicated appliances that I made would never have gone to place had there been a thousandth part as much shrinkage or expansion as is supposed to take place. We have had demonstrated to us in California that a proper, careful technic gives us good inlays regardless of the material used for investment, the manner of burning out the wax or the mode of actually casting the metal. Perfect inlays can be made with any inlay wax, any inlay investment, any casting machine, provided a proper technic is used together with a proper alloy for the case in hand. It is time for the dental profession to know the formulas of the alloys it is asked to use.

3. Ney-Ora: Gold Alloys, p. 11.

4. Turner: Prosthetic Dentistry, p. 119.

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Editorial

HOW ARE WE TO DETERMINE?

From a prominent member of a state board of dental examiners comes the following observation, suggested by the editorial in our May issue "A Lesson for Dentistry." Speaking of the moral qualifications of candidates for state board licensure, he says: "How are we to determine the moral status of the men coming before us? Recommendations from deans and faculty members are easily obtained, as are those from politicians in one's home town; so that in reality all these count for naught." And then he makes a plea for us to assist in reaching a basis for judgment in this question.

This plea carries with it an implied compliment which we are not disposed to accept—it implies that we are in a position to make suggestions for state boards whereby they may determine the moral status of their applicants. But this is the very thing that we do not feel qualified to do. We agree that the question is one of the most important facing the dental profession, and yet it is

assuredly one of the most difficult. To keep out of the profession men lacking in moral fiber is an absolute necessity if we are to have a profession whose status is to rank with the best in human endeavor; but as the distinguished member of the state board implies, it is not possible for dental examiners to determine this question, nor is it their function. In the very nature of things, they cannot be expected to do this. They come in contact with the candidates only a few days at most, and without any possible means of determining such an intricate thing as moral or immoral propensity.

No, if anything is to be done, it must revert back to the colleges, and there must be a regeneration of the attitude of many college teachers in this important matter. The assumption on the part of college authorities and instructors that their duty embraces only instruction in the science and art of dentistry, and that they have nothing to do with the moral rectitude of the students is fatal to the highest service to which they are ordained as directors of the destiny of young men. Again and again has the fact been emphasized that morality means more in the great scheme of life—particularly of professional life—than any other single factor; again and again has the concrete proof of this been demonstrated in the lives of men. There is no blinking of facts in this particular, no hedging of the fundamental issue at stake.

No wonder our state board examiner sends out an appeal for help. He, with many other worthy men on our state boards, is obliged to license men to practice without the slightest knowledge as to their moral fitness, and without the means of obtaining that knowledge. He must take the product presented to him by the schools, and make the best of it; in other words, he is at the mercy of the colleges, and so is the public. It therefore devolves on the schools to supervise more assiduously the kind of young men they send out, with special reference to their moral or immoral tendencies. And there may be a large crumb of encouragement to our state board examiners in the assurance that, in some of our schools, this matter is given more attention than they suppose. We believe that, in many dental schools, there is a pronounced

effort being made to control the moral behavior of students and to weed out the unworthy. It is true that it is not always possible even for teachers to know all about the conduct of every student, but an honest attempt is made to judge the fitness of prospective candidates, and our state board officials would probably be surprised if they knew the number of young men who are dropped from the college rolls on one pretext or another when the real reason is a moral one. The difficulty of proving moral delinquency makes it necessary to exercise caution in deposing a student, but we happen to know that many a young man has lost his chance to continue in a dental school through habits which put him without the pale of professional rectitude.

And yet with all the supervision that may be thrown around a young man in college, we know, of course, that it is impossible to check up on every candidate with accuracy, and we doubt not that some irresponsibles find their way past the college authorities and present themselves before state boards for license. No sovereign remedy for this has ever been found, and we do not wish to be considered pessimistic when we express the doubt that it ever will be. We have never achieved perfection in any of our professional activities, and the millennium of dental education and licensure is not yet here; but, with all the limitations of our present system we have at least gained some ground, and we think we present to our state boards a better product both in scientific training and in moral rectitude than we did in the past.

Let us be thankful for the progress we have made; not with the smug complacency which rests content with present achievement, but with the encouraging conviction that we are at least playing the game and are hopeful that we may play it better in the future. We are in full accord with the contention of the state board examiners that they are helpless as far as the moral status of their candidates is concerned, and that the chief responsibility rests with the schools; but all we ask is that miracles be not demanded of our college authorities, and that the examiners remember that the teachers are human. After all, the college gets its material from the home, and may it not be logical to carry

some of the responsibility back to the environment in which the student lived before he came to a dental school? This we happen to know, that many a young man of questionable tendencies has been molded into better lines of conduct and aspiration through the influence thrown around him in a dental school, and while some young men have doubtless drifted downward during their college course, there are as many others who have been built up into men of principle and right living by daily association with their instructors in a professional school. The ostensible *motif* of a professional education is to make of the student a worthy professional practitioner, and with the record made by our dental schools in the past, it cannot be charged that they have altogether failed.

AN OPEN LETTER TO A DENTAL STUDENT

In the course of a lecture to a class of students, the teacher was emphasizing the advantages of membership in dental societies, and of course he stressed the American Dental Association. The following question was passed down by one of the students: "What advantages do men lose by not belonging to the American Dental Association?"

This same question may possibly find lodgment in the minds of other students, and even of some men already in practice, so it was thought desirable that this boy might be answered with an open letter. Here it is:

My dear Boy:

The greatest incentive that professional life holds out to a man is the inspiration he gets from association with his fellowmen. To be a hermit is to stultify ambition and to shrink into the narrow confines of introspection. Few hermits have ever achieved anything great in the world or ever got much happiness out of life, and the most pitiable hermit of all is the professional one. No really great man in medicine, or law, or dentistry or any of the professions has ever been found outside the organized

association of his calling. No man in dentistry has ever developed to his full stature without being a member of dental societies.

Even if a man elected to educate himself and keep abreast of professional development by reading its literature, and even if he read everything that appears in print, he would fall far short of getting the spirit and essence of real advancement without association with his fellow practitioners. It is the personal contact that counts most in the dissemination of ideas and in the development of character, and no dental practitioner can afford to remain outside professional organizations if he has any amibition to be a cog in the wheel of dental progress.

The greatest men in all professions have been the most ardent supporters of their associations. Take dentistry and run over some of the names: Harris, Hayden, Webb, Bonwill, Atkinson, Perry, Kingsley, Miller, Black, Cushing—the list might be extended indefinitely, and every one of them an enthusiastic member of dental societies. Not a single name can be mentioned of any man who has contributed concretely to the advancement of dentistry who was not a member of a society.

You do not want to figure as a cipher in the great scheme of professional achievement, do you? Because achievement is going on in dentistry. It is developing as no other profession of its age. And do you wish to be considered as a nonentity in this profession, or even not be considered at all? Do you wish to go through your professional life with the tag of inferiority tacked to you?

No, my dear boy, you cannot afford to ignore the benefits to be obtained from joining a dental society, and particularly the one organization which stands out as representative of the best there is in dentistry. Membership in the American Dental Association, coming as it does through component societies, brings many privileges and much in the way of inspiration and compensation. There is a certain thrill in the mere fact that you are an integral part of an organization enjoying a membership of more than 30,000, and you will lose something of real and tangible

benefit if you fail to avail yourself of the privilege of affiliating with such an organization.

"What advantages do men lose by not belonging to the American Dental Association?" They lose every advantage which makes professional life worth living. They lose the greatest incentive to progress, and the greatest opportunity of service; and service, my dear boy, is the one supreme source of happiness. If you do not wish to be happy, then gather your mantle about you and hibernate in the hollow of your own self-conceit; but if you care for happiness be assured that you can get it only through a whole-hearted cooperation with your fellowman.

I extend to you a cordial invitation to membership in the American Dental Association, and I promise you as a reward the satisfaction of a full professional life which will bring to you the surest solace in your declining days.

With all good wishes, I am,

Sincerely yours,

C. N. JOHNSON.

FLOOD SUFFERERS AMONG DENTISTS

A letter from Dr. W. R. Wright of Jackson, Miss., written in May indicates something of the conditions existing in the South at the time of the recent floods. He says:

> In answer to your remark about the flood situation, will say that those at such a distance as you live will find the full significance and horrors being experienced down this way hard to grasp. It is safe to say that no professional man within seventy-five miles of the Mississippi or Yazoo valleys will escape without heavy losses; while thousands of dentists depend entirely upon the Delta section for their business, and many have placed their entire savings in the lands and properties which are at present under many feet of water.

It is well for the dentists of the other sections of the country to realize what our colleagues of the South have been obliged to face in meeting the flood situation. The heart of humanity has gone out to the sufferers in this calamity, and we of the dental profession may well extend our sympathies to our brothers of the

flood districts to the extent at least of letting them know that we have not been unmindful of the trials through which they have passed.

A NEW DEPARTMENT

Within recent months, a new department has been organized in the central office of the American Dental Association under the able direction of Mrs. Josephine Hunt.

Already, three kinds of service are in operation:

A package library, whereby members who contemplate writing papers on any subject may apply to the department and receive a package of reprints and clippings on that subject, and have the use of them for one week at a nominal charge of 50 cents, to cover partially the cost of assembling.

Bibliographies, consisting of lists of references to magazine articles and books, which are compiled on request, the minimum charge for which is $1.00.

Circulation of books, which may be borrowed from the library of the Association for one week. Requests for book loans should be accompanied by $2.00, which will be refunded promptly on return of the book.

It is contemplated to extend the service into an exchange library whereby duplicate copies may be exchanged with other libraries. To this end, an appeal is made to the profession to donate copies of books or magazines to the library of the A. D. A., so that the exchange service can be extended to the greatest limit, and the library built up to be a credit to the Association.

The response of the profession to the new service has been most encouraging. Mrs. Hunt is extremely busy meeting the calls from our members, who have been quick to take advantage of the opportunity afforded, and it is confidently hoped that this department will serve to link our membership more intimately to the central office than ever before and thus tend to prove the great value of association effort.

DEPARTMENT OF DENTAL HEALTH EDUCATION

SOME ESSENTIALS IN A DENTAL HEALTH PROGRAM*

By WILLIAM R. DAVIS,† A.B., D.D.S., Lansing, Michigan

CONSIDERATION of mouth conditions as a phase of public health is of comparatively recent origin. It is true that occasionally a physician or dentist many generations past wrote down his belief that serious bodily disorders sometimes have their origin in diseased teeth. Dr. Benjamin Rush, for whom Rush Medical College in Chicago is named, a famous physician in the days of George Washington, has recorded many cases from fits to menstrual disturbance cured by extraction of teeth. Yes, rheumatism was in this list too. But medicine was in those days unscientific, and one guess was as good as another. It was not until our own scientific age, when medicine, not content with guesses, gave much time to study and investigation of causes, that diseased mouth conditions became definitely associated, as a cause, with disease in other parts of the body.

Even yet, many are unconvinced; but such internationally known men as Hunter, Mayo and Osler in the medical profession have brought about quite general acceptance and most of their findings have been confirmed by clinical experience and reason.

Many in the dental profession had long contended that a relationship existed, but were certainly unprepared for the swing in the medical profession from calm indifference to feverish anxiety to lay the blame for most any condition on the teeth.

But it has been a rather common experience of both the medical and dental professions to seize on any new thing and overemphasize it out of all true proportions. A book could be written illustrating this tendency and sufficient examples will occur to the minds of those who have been in practice even a few years.

Hunter, Mayo and Osler were not in this class, and our best leaders in the dental profession were not. However, the emphasis and enthusiasm have done good in centering attention on a problem

*Read before the Missouri State Dental Society, St. Louis, Mo., May 23, 1927.

†Director, Bureau of Mouth Hygiene and Preventive Dentistry, Michigan Department of Health.

which had to be solved even if some evils attended. Certain it was that mouth infection could not have been much longer ignored. Science was making too rapid strides in conquering disease to neglect such possibilities of danger as were found in the mouth. Sooner or later, the mouth had to be recognized as a part of the whole.

Scientific medicine, then, searching for the cause of disease has, we believe, brought general acceptance today in medicine and dentistry that mouth infection is a menace to health and may cause serious lesions in heart, kidney, joints and other parts of the body. The question of the extent of these sequelae, the question as to when mouth infection is present in "dead teeth" and whether these teeth can be treated successfully is not a part of this discussion. The important thing for us is that mouth infection *is* tremendously prevalent and that it *is* a menace. This has, in a few years, brought dentistry from an aesthetic art to a science which has to deal with matters of life and death. This transition has brought to dentistry a great responsibility and is carrying it into the domain of public health. As the science of public health is realizing the great importance of prevention, so must dentistry, and dentistry is doing this, as the growing use of the term "preventive dentistry" signifies. It is not nearly so spectacular to prevent as to cure, but it is certainly much more satisfactory from the standpoint of well-being, as well as of economy.

This new importance and vision of dentistry have brought much enthusiasm and many plans. It was to be expected that proper balance and emphasis would not always be maintained. This is always true of a new effort, and no criticism of the splendid pioneers who have wrought with unselfishness and vision. However, enough time has now elapsed for us to take stock of methods and plans. In this light, let us then consider some of the essentials in a dental health program.

The most important essential is, we believe, a clear understanding of our objective. This has not always been kept in mind, and it is responsible for some of our tangents. Sometimes, we are not sure where we are going, but we hope we are on the way. But if we wish to arrive surely and directly, we must know our destination. We cannot emphasize too strongly that this destination is the removal and prevention of mouth infection. It would seem that this should be self-evident; but it is surprising how many dentists, when asked the aim of a dental health program, answer at once, "Education." Education is only one of the means to an end. Education can convince of the necessity: it cannot remove or prevent. Unfortunately for us at the present time, the dentist himself has to do practically *all of the removing and most of the preventing*. This is too often overlooked, and I want you to ponder it carefully and see whether I am not right. Many dentists who strongly advocate a dental health program, which means to them recognition on the state health board, lectures, posters, toothbrush drills, hygienists—in other words, education—are not willing to do their share in the removing and preventing of disease conditions, especially in chil-

dren. Let me ask you in all seriousness just how much good all these things will do unless the dentist does his part? In other words, if our education convinces nurses, parents and school teachers that abscessed deciduous teeth are a menace to health, and the parent takes the child to a dentist, who says, "Leave them alone," our education has only wrought confusion in the minds of those interested in the child. Or if our education stresses the necessity of starting the child to the dentist at 2½ or 3 years in order that defective pits and fissures may be given attention, and the dentist doesn't fill those which need filling here, again education has not accomplished its purpose. Keep in mind, then, that education is only a means to an end, and that end is the removal and prevention of mouth infection.

Let us analyze, for a moment, this matter of prevention. Of what does it consist? I am convinced that today there are just two means which we have that are of much value in preventing dental infection. One is diet and the other is early care by the dentist. The last word has not yet been written on diet, but we know it is important, and perhaps, as far as good teeth are concerned, is most important for the mother before the child is born and in the first few months and years of life. We believe that correct diet has great value at any time in life in retarding or preventing decay, and consequently should be promoted.

But the unfortunate fact today is that the majority of molar teeth, and some of all the teeth, have pit and fissure defects, and, if these are not given attention at once by a dentist, decay and infection are imminent. It is the work of our research departments to find out the cause of these defects and how to grow perfect teeth; but while they are doing that, we must deal with conditions as they are. The facts are that 20 to 70 per cent of school children already have mouth infection from one to eight or ten artesian wells, and that 70 to 90 per cent either have infection or are on the road to infection with cavities in teeth. This is not only a menace to health but also greatly retards school work.

Nearly ten years of experience in public health dentistry, which has included much actual operative work for children, as well as examination with mouth mirror and probe of many thousands of school children, has convinced me that we simply cannot overemphasize this matter of early attention to pits and fissures. It is the one big practical thing we can do in preventing mouth infection. We say to the dentist, "Use a fine sharp explorer; if it sticks at all or there is any question, fill the tooth." You can't make a mistake in filling, but you can make an irreparable mistake in not filling it. Every dentist who carries this out in practice will have the experience many times of encountering quite a cavity of decay where the explorer would scarcely catch at all in the pit or fissure.

We are glad that many prominent dentists are coming to recognize this as the most important practical means of prevention which we have. Unfortunately, in too many dental offices today we cannot even find a fine, sharp explorer. Dentists, we cannot practice

preventive dentistry with broken explorer points. Look yours over carefully when you get back to your office and remember that it is your responsibility to do most of the prevention and removal of mouth infection, which is the aim of dental health. You cannot lay the responsibility on the toothbrush, hygienist or spinach.

This brings us to a consideration of some of the fads which have developed in our dental health programs. The greatest of these has been the overemphasis on the toothbrush and that old slogan, "A clean tooth never decays." In many school dental programs today, the whole emphasis is on toothbrush drills and clean teeth. In most of the dental health films and plays that have been produced, the toothbrush is given the prominent part, with very little, if any, emphasis on early dental care, and wrong impressions are left on the public. The teaching going out very generally from these means leads the public to believe that children's teeth decay because they were not brushed enough and also that even after they are in a deplorable state of advanced decay, with toothache and swelling a few visits to the dentist make them just as good as new. Now, as a matter of fact, both of these impressions are false, and harm rather than good is going to ensue in the long run.

Examination of school children shows that the toothbrush is a small factor in preventing decay, and we know that the dentist cannot make badly decayed and abscessed teeth as good as new. At best, these teeth will always be cripples even if they are retained. Do not get the impression that I am condemning the toothbrush. I believe that its use is a valuable habit and should be encouraged. It helps to promote health just as do other habits of cleanliness; but as a preventive of decay, its value has been vastly overestimated and cannot compare at all with diet and early dental care. When parent-teacher associations or other groups are told that many teeth come through with pit and fissure cavities and these defects must be filled very soon to insure sound teeth, they regard this as an entirely new and startling thought; and yet it is the most important item in our dental health program. Many school nurses have not gotten this point, although they are rapidly getting it in Michigan. Our dentists even have been slow in realizing the importance of early filling of defective pits and fissures as the great preventive measure. Have you any dentists in Missouri who still tell patients that the cavity is too small to be filled? If so, and if as loyal residents of this great state they insist on being shown, take them to a school examination.

We have been trying to find an easier way and hoping someone else could do the job for us. That time has not arrived. Not until our research departments tell us how to grow absolutely sound teeth immune to caries can we sit back and "let George do it." Even then, we will still have the present generation and those who have not heeded; so it will be a long, long time, far in the future.

We cannot even pass our responsibility to the hygienist. She can be a valuable assistant to the dentist, but her field is limited. When from 85 to 95 per cent of school children need extractions or fillings, a whole army of hygienists cannot do this needed removing and preventing of mouth in-

fection. When school nurses report that their biggest problem is getting dental corrections, how will the hygienist get them if the nurse cannot? The hygienist can help you work more efficiently, but she cannot do your work. We are saying these things to bring home to the dentists, just as strongly as we know how, the importance of children's dentistry and early children's dentistry, and that the final result of any dental health program that is going to show results depends on your work in your offices. I fear that education of the public is going faster than the dentists are in meeting it. As a matter of fact, a dental health program is to be judged not by the noise it has made but by the change it has made, especially in children's mouths, and the dentist has to make nearly all this change. It is unfortunate that a dental health program must drive people to the dentist if it is to succeed as at present, but it is fortunate that we can say that preventive dentistry—filling defective pits, fissures or other small cavities—is the easiest for the patient, costs the least and lasts the longest. This is working for the interest of the patient rather than of the dentist.

We have tried, then, to get a true perspective of our objective. We have pointed out the danger from overemphasis in some directions and underemphasis in others. It is also essential that we give heed as to the way in which we can best promote this dental health program. Here, our education comes into its proper place. Education should cover the prevalence of mouth infection, its dangers, necessity of removal, importance of prevention and the fact that prevention consists mostly in proper diet and early dental care. This education can be carried on in many different ways, such as through lectures, pamphlets, posters, plays and the radio, but these are only means to an end. Do not forget the end. There is danger of depending too much on lectures and publicity. When the public asks you *how*, what are you going to tell them? Suppose they say they cannot find a dentist in their community who works for children?

We believe also in working through existing agencies as much as possible rather than in creating new ones. Dental health is just one phase of public health and should be joined in every way possible with other health programs. A health program that does not include all measures for promoting health is unbalanced. This is not only the most effective way but also the most economical way.

We find our best contacts through health departments and other health agencies, and especially school nurses and parent-teacher organizations. We have no more valuable ally than the school nurse, and when we can bring together the nurses, teachers and local dentists in promotion of a sane program of dental health, we know that we are going to get results, and if our program does not do this, it is going to miss its aim, I care not how pretentious. Concentrate on a few things well done rather than spreading out on too many plans. Some figures may not be so large, but remember that the real figures are to be found in the mouths of the children of your community.

Actual examination which shows real accomplishment in the removal and prevention of mouth infection is the only test, and it is the acid test, of any dental health program.

PRESENT STATE OF ORAL HYGIENE IN JAPAN*

By MITSURA OKADA,† D.D.S., Tokyo, Japan

DENTAL science has, in recent years, made a great development, keeping pace with progress in other branches of preventive medicine. Dentists of all civilized countries have contributed a great deal toward the growth of the science. They have, from time to time, made public the results of their researches and approached their own governments with proposals suggesting the necessity of taking proper steps for the improvement of national health and for the popularization of the knowledge of oral hygiene. They have spared no effort for the perfection of the science and have brought oral hygiene to its present status. It was not, until 1894, when the second dental conference was held at Copenhagen, Denmark, that the problem of oral hygiene came to be internationally debated by dentists for the purpose of improving dentistry through the exchange of views. The resolution adopted at this conference is, in substance, as follows: "As decayed teeth are prevailing among the civilized countries, effective preventive measures should be taken against the disease, especially in children. For this purpose, the first thing is to teach rational methods of oral hygiene throughout the country. For those children who cannot afford to pay for it, treatment shall be given free of charge."

The conference of 1894 was followed by oral hygienic movements in many countries. Ernst Jessen, of Germany, established, at his own expense, a school children's dental infirmary at Strasburg, in 1888, the only institution of the kind that existed in the world. The next year (1889), the School Dentists' Society was organized in England through the efforts of W. Macpherson Fisher, and much was done for the progress of school dentistry. The International Dentists' Conference was held in 1900, and as a result, the Fédération Dentaire Internationale was inaugurated, and an agreement was arrived at to the effect that members of the Fédération should, as a body, and in the spirit of public benevolence and mutual help, endeavor to carry on their propaganda for the promotion of world-wide oral hygiene. Several conferences were afterwards held and many problems were taken up, with fruitful results, and steady and concrete improvement in the theory as well as in the practice of oral hygiene. As time passed, the problems of national health began to be seriously considered by statesmen, officers, and others. Especially was the problem of oral hygiene recognized by the general public, as well as by government officials, as an important matter from the standpoint of promoting health. Thus, the oral examination of school children was carefully carried out, and encourage-

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ment was given hygienic work in factory and army.

In Japan, as in many other countries, dentistry has made rapid progress. It is true that the dental science of Japan is as yet less advanced than that of England, America or Germany, and there is much for us to learn from them; but the origin of our dental movements may be traced back to about the same date as that of America. With their superior monetary power and their far-advanced knowledge of public hygiene, America and many of the European countries far surpassed Japan with respect to the progress of dental science, a remarkable difference in growth resulting. Shall we remain inferior in this respect? We cannot. We must make every possible effort to improve ourselves. In order to elevate our oral hygiene, better equipment is needed, superior apparatus will be necessary, and above all, and most essential, hygienic knowledge must be popularized. It is, therefore, most desirable that the government and people cooperate in bringing this objective to an actuality. Speaking nationally and individually, we must give more attention to things pertaining to oral hygiene and must push forward toward the betterment of our oral health. Such should be the goal of the Japanese dental propaganda.

The rise of the oral hygiene movement in Japan dates back to 1912, but, before that, there were indications that the importance of dental hygiene had, in some quarters, been recognized. Thus, at the time of the China-Japan and the Russo-Japanese wars, dental surgeons were taken into service to care for the officers and soldiers at the front. The appointment of dentists by the army and navy was first given a trial in Japan. Therefore, it may as well be said that we were a step ahead of America and some other countries, as far as this point is concerned. In 1901, the Kojimachi Ward Office, Tokyo, employed four dentists for oral examination of school children in the ward. This was the first school dentistry in Japan. In 1903 the Japan Dentists' Society nominated a dentists' acts investigating committee, to conduct investigations concerning the enactment of new laws. A law was enacted in 1905 which led to the formation of the Japanese Dental Hygiene Investigation Society, in the spring of 1908. The Society, cooperating with a dentifrice manufacturing company, started a campaign for the promotion of oral hygiene. This was indeed the first propaganda in this country. In the summer of 1910, when the completion of the buildings of the Nagasaki Prefectural Office was celebrated, a dental exhibition was held at Nagasaki in commemoration of the occasion. This was the first dental exhibition. In the following year (1911), when an alumni meeting of the Tokyo Dental College was held in the City of Osaka, an opportunity was made for carrying on propaganda work. Lectures on the subjects of oral hygiene were given and an exhibition was also held. This method of propaganda was immediately taken up by the cities of Matsuye, and Oita and various other places all over the country. Local authorities also participated in and backed up these movements, with successful results. In 1912, a booklet entitled "Dental Hygiene" was published by the All-Japan Dentists' Society. In the same year, Kobayashi Co., manufacturers of a dentifrice, established an oral hygiene

department, and commenced propaganda lectures on oral hygiene; first, for primary school teachers and children, extending their activities by degrees to the general public. This was the first campaign that had ever been undertaken by private merchants in this country. In April of the same year, the Tokyo Prefectural Third Higher Girls' School opened a dental room in the school building in commemoration of the imperial silver wedding. This was the first dental surgery ever established in a school building in this country. In January of 1915, a revision of the dentists' law passed the diet, and more strict restrictions were imposed as to the qualifications of self-styled dentists. As a result of this law, the position of educated dentists was elevated, and a bill for the examination of the dentures of school children submitted to the diet was approved by the government and unanimously passed by the two Houses, in March, 1918.

In April, 1919, it was officially announced that dentists' officers would be appointed to take charge of the first and second class garrison hospitals. This was due to experiences met during the World War. In the same month, the Oral Hygienic Investigation Society was established by the All-Japan Dentists' Society, and, in June, government officials and dentists met together for the purpose of spreading the knowledge of oral hygiene. Thus, the importance of the dental movements have come to be thoroughly understood and have been approved by the authorities.

In 1919, a lecture meeting on oral hygiene was held under the auspices of the All-Japan Dentists' Society. In October of the same year, when a children's exhibition was opened at the Educational Museum, under the auspices of the Home Department, "Decayed Tooth Day" was planned and carried out. This was the first exhibition of its kind ever attempted in Japan and the results were unprecedented.

In 1921, dentists were employed by some government offices, schools and other institutions. Thus, we see dentists taken into the services of the railway department in November; of schools in the City of Chiba, in April, and of the educational department of Tokyo municipality, in June. In the spring of 1922, the departments of finance and home affairs and the printing bureau also employed dentists. In the printing bureau, a dental infirmary was constructed, typical in accommodations and equipment. In the same year, another infirmary was opened in the Hoshi Pharmaceutical Company for the treatment of the employes. Sept. 1, 1922, we were visited by the disaster which reduced almost all of Tokyo to ashes and devastated the district near the capital. All dental equipment and laboratories in the district were destroyed. Many dentists were left homeless and did not know what to do for a time. In spite of the disaster, although they were placed in such a helpless condition, they were too courageous to give up. For four days after the disaster, despite their own misery, they volunteered to organize relief parties and they accomplished much for the benefit of the public oral health. Government authorities and municipal officials also took part in the relief work. Poor refugees were able to receive dental treatment amid chaotic confusion. Temporary dental surgery rooms were erected at various places and corps of

dentists were sent out to give aid. Even lectures on oral hygiene were given from time to time. Toothbrushes and tooth powder were offered to the public free of charge. Propaganda pamphlets were cast on the wind. The interest of officials and others in the work made a deep impression on the minds of the general public and helped spread the knowledge of oral hygiene. In December, 1922, the Oral Hygiene Department of the Lion Dentifrice Manufacturing Company, and Oral Hygiene Department of the Club Dentifrice Manufacturing Company sent out dentists to examine primary school children.

In January, 1923, the Nakayama Oral Investigation Institution was established at Osaka.

In 1923, typical school dental clinics were established in Bancho Primary School, Kojimachi Ku, and in Hongo Primary School, Hongo-Ku. Furthermore, another dental clinic was opened in the primary school of Kofu City. This, the first school dental clinic ever established in the local districts, is run at the expense of the resident doctor, Hide Ogawa, and the work promises success. Another dental clinic was also opened, in November, in the Japan Women's College, under the supervision of Ofu Kai, an organization consisting of the graduates of the college. Still another dental clinic was opened in the same year in the Tokyo Prefectural Sixth Higher Girls' School. Thus, much has been done for the development of the school dental work and for diffusion of the knowledge of dental hygiene. It has recently been announced that every primary school to be reconstructed in the future should have a dental room in its own new building. We have seen how earnestly the problem of oral hygiene has been discussed and how the popularization of a knowledge of dental and oral hygiene has been planned and actually carried into practice in this country. Rome was not built in a day. Oral hygiene in Japan has met many hardships up to the present stage. The number of dentists in Japan is at present estimated at about 10,000, and they are practicing almost everywhere throughout the country. There are five colleges under the control of the Department of Home Affairs, sending out about 600 graduates every year. Such being the prevailing conditions, further sound development can be expected from the oral hygiene work in Japan.

PRESENT SOURCES OF PROPAGANDA FOR ORAL HYGIENE

Dental Educational Organs.— As dental educational organs, we may enumerate the following schools:

Tokyo Dental College (Morisaburo Chiwaki, LL.D., president), the oldest institution of its kind in Japan.

Nippon Dental College, (Ichigoro Nakahara, Sc.D., president).

Osaka Dental College, (Totaro Asahina, D.D.S., president).

Dental Department of the Nippon University (Kazuwo Sato, D.D.S., M.D., president).

Kyushu Dental College (Kuniomi Kuninaga, D.D.S., president).

Dental College of Korea, (Takken Nagira, president).

Meika Girls' Dental College, (Shira Kayama, president).

Tokyo Girls' Dental College, (Senrun Okubo, president).

In addition to the foregoing, a dental college under the direct control of the Department of Education is to be established. Furthermore, the Imperial Medical College, Keio Medical College, Kyushu Medical College, Aichi Medical College, Kyoto Medical College,

Osaka Medical College, and Chiba Medical College all have their own dental departments.

These facts simply tell how the necessity and importance of dental science has come to be realized by both the government and the people. The Red Cross Hospital, the Imperial Charity Hospital, the Railway Department Hospital and others all over the country, large and small, governmental or private, are all planning to build, or to further extend, their own dental departments. No wonder that such development in dental education should be reflected in increased dental knowledge of the general public.

Periodicals.—The following dental periodicals are published in Japan: *Dental Science, Dental News, Toyo Monthly Review, Dental and Oral Magazine, Korea Dental Magazine, Japan Dental Science, and Women's Dental Magazine* (all devoted chiefly to scientific study of dentistry); *Dental News Magazine, Review of Dentistry, Nippon Dental World, New Dental Journal, Chukyo Dental Review, Dental Public Review, Nippon Oral Hygiene, and Dental Newspaper* (these intended for reviews and criticisms of dental science).

These magazines and newspapers, discussing scientific topics and reporting current news, personal affairs, foreign news and so forth, perform a great service.

Printed Matter.—Several books, booklets and pamphlets disseminate propaganda: "Tooth Hygiene," published by the All-Japan Dentists' Society, for the general public as well as dentists, and "Shiga-no-Eisei," published by the Hygiene Bureau of the Home Department.

Newspapers, Home Magazine and Other Popular Magazines.—Articles containing subjects on dental and oral hygiene sometimes appear in the "home column" of a newspaper. These articles are written in various styles, sometimes scientifically, sometimes in an informal style, sometimes dramatically and at other times even poetically, but in all cases make easy and interesting reading. Such articles appearing in newspapers may do a good deal to popularize oral hygiene.

Radio for Propaganda Work.—Propaganda by aid of radio was tried in 1925 for the first time, and seems successful.

Posters.—There are such numerous methods of propaganda by the use of posters and pictures, that we can scarcely mention them all here. One thing that should be noted is this: The authorized textbook for primary school boys and girls has had the word "tooth" added for the purpose of impressing on the young mind the importance of keeping the teeth healthy.

Census of Dentists.—According to the census of dentists throughout the country for August, 1924, by the All-Japan Dentists' Society, registered dentists number 10,254, of which 2,081 are not registered or have died. Besides, there are about 100 self-styled dentists. Therefore, about 10,000 dentists are at present in actual practice in Japan.

As compared with the population in Japan, this number makes the ratio of 1:7,092. In the number of dentists, therefore, Japan equals America, but it is impossible to assert that this numerical superiority indicates better oral hygiene, and much more so when we consider that, in America, quite as many

dentists are working in the public service as in schools or hospitals. In our country, too, the government authorities and dental experts are cooperating for the popularization of hygiene, and they are working earnestly to prepare the way for public service by the dentist. It is certain that the day will come when an important place will be given to our dentistry in the world of oral hygiene.

PRESENT STATE OF ORAL HYGIENE IN JAPAN

While the propaganda for the popularization of hygiene is, as we have stated above, extensive, an observation of the actual state of oral hygiene reveals quite contrary facts. According to the examination, statistics from various quarters regarding dental caries, gingival diseases, and above all, pyorrhea alveolaris and malarrangements of the teeth, our expectations are not met. The statistical figures given in the following tables are taken from the records of Kobayashi and Company and also those of the Nakayama Propaganda Department.

The "Lion" Lecture Society.—This society, established in 1913, gave an impetus to education through lectures at a time when the general public had no knowledge of oral hygiene. Through constant endeavor, the society spread a knowledge of oral hygiene all over the country and did a great deal to bring about its present popularity. The work of the society has come to be accepted by the general public with hearty approval. Lectures were given at schools, in young men's associations, in the army, in factories and to others, who were educated through movies and by means of demonstrations with models. Up to May, 1924, 4,214 lectures had been given, and the audiences numbered no less than 2,900,747. The propaganda work of the society has covered Formosa in the south, Hokkaido in the north and as far as Korea. Few parts of the country have not seen the footprints of the lecturers of the society.

Oral Hygiene Training Course.—It is a matter of importance that oral hygiene be well understood by primary school teachers, whose duty it is to educate children. That they be fully equipped with this kind of knowledge is a necessity from the point of view of oral hygiene education. The teachers must be expert in the training of school children in matters of hygiene. For this reason, the first Oral Hygiene Training Course was opened in Tokyo in 1918. The work of training teachers continued, and courses were given at Osaka, Kyoto, Fukuoka, Sapporo and Kobe during every summer vacation or at any other time when required. There were eleven such meetings in all and the students numbered 2,089.

The number of teachers who finished the training course is shown in the accompanying table.

School Dental Inspection Association.—This association was established at Osaka in 1924. An organization similar to that of school dental inspectors was started at Tokyo. Though not so long in existence, since its establishment it has accomplished marvels. Lectures are given and moving pictures and many other types of propaganda are employed. The number of schools inspected were, in September, 1924, sixty-three, with 82,759 children. The children's dental department of Osaka, in the Citizen's Hall, is under the control of the Osaka Dentists' society. It

is intended to give dental treatments solely to children.

The Lion's Dental Infirmary for Children.—This infirmary was opened in 1921 for the purpose of taking care of child patients. The work of the infirmary proved successful. The total number of the young patients who had been given dental treatment up to the time of the earthquake was 42,300. This is the only institution in Japan designed for the sole treatment of patients younger than 15 years of age. The infirmary drew the attention of those interested in social improvements.

Its object is to accomplish also: 1. Training of oral hygiene assistants, or school dental nurses. This was started in 1922. Lessons are given as to how to keep the teeth clean and other important subjects. 2. Meetings. A meeting is held monthly in which primary school teachers meet together and lessons are given on oral hygiene. This meeting is like the training course, on a small scale. Those who have up to now been present in the meetings number 373. 3. Guardian's informal meeting. Guardians meet informally once a month for the purpose of improving home hygiene. There have been three meetings, those present numbering 185. 4. Lectures on and practice in cleaning teeth are given, when requested, within the city.

5. Training course in home hygiene. This course was planned for increasing the knowledge of girls regarding general home hygiene. Lecturers in this course were all of high scholarship. This course is, no doubt, helpful to future housewives. The number of students attending this course was as follows: Osaka, 105; Kobe, 86; Kyoto, 150; Tokyo, 85; Yokohama, 44; Nagoya, 300; total 685.

6. Children's exhibitions. Models and illustrations were exhibited under the auspices of the Hygiene Bureau of the Home Department. There were twenty-seven exhibitions in all at Tokyo, Osaka, Nagoya and other places, and much interest was created.

7. Oral hygiene exhibits. For the purpose of popularizing the knowledge of oral hygiene, we have exhibitions always open in Tokyo and fifty-seven other places throughout Japan, where models, illustrations for school use, statistics, etc., regarding oral hygiene are prepared for observation and study of visitors.

8. Moving picture shows. We pay great attention to the popularization of dental knowledge by means of moving pictures. For this purpose, we have

NUMBER OF TEACHERS TAKING TRAINING COURSE IN ORAL HYGIENE

	First meeting	Second meeting	Third meeting	Fourth meeting	Fifth meeting	Sixth meeting	Seventh meeting	Eighth meeting	Total
Male normal school	4	1	1	0	2	0	5	2	15
Female normal school	1	0	1	0	1	1	0	0	4
High school	5	3	5	3	6	1	5	6	34
Girls' high school	14	29	13	11	12	2	11	10	102
Industrial school	4	12	5	4	7	4	5	11	52
Primary school	121	178	175	292	238	50	126	255	1,435
School doctors	5	4	4	0	3	2	0	2	20
Total	154	227	204	310	269	60	152	286	1,662

recently prepared eight films, besides the two old ones "Momotaro, the Curer of Carious Teeth," and "The Teeth and Knowledge About Them." The eight newly produced films are all scientific studies in oral hygiene, and yet very interesting and easy of comprehension by the majority of people. The first is entitled "Origin of All Diseases," the second, "Carious Teeth and Tuberculosis," the third "The Appearance of the Permanent Teeth," the fourth "The First Permanent Molars and the Third Molars," the fifth, "Carious Teeth," the sixth "How to Prevent Caries," the seventh "How to Strengthen Teeth," and the eighth "Community Work for Improving Oral Hygiene" with a story entitled "War in the Oral Cavity," attached to it.

We gave many moving picture shows to the public throughout the country, and intend to invite more people to view our pictures.

9. Children's oral hygiene play. Last April we gave, at Osaka, a children's oral hygiene play entitled "A Tale of the Land of Teeth," written by Yoshio Mukai.

10. Hygiene association.—An association of school children has been formed to spread the rules of daily hygiene, such as tooth brushing before going to bed, the sanitary value of rinsing the mouth after each meal and of making deep respirations, and of many other good habits. The members of the association now number about 200,000, and are increasing every day. We distribute, from time to time, fine cards, etc., in order to renew their interest in oral hygiene.

11. Posters and pamphlets. Every year, we distribute among children posters, pamphlets and booklets with instructions about oral hygiene. In recent years, we have been almost overwhelmed by the demands for this literature, from various districts of Japan.

Among our booklets, we have "Home and Oral Hygiene at School," "Women and Oral Hygiene," and "Inquiries and Answers on Oral Hygiene." In addition, we have published a periodical entitled *The Dental Cosmos* since 1918, which is one of the best of the few magazines of this type issued in Japan.

THE HYGIENIST IN THE SCHOOL

By MARGARET A. BAILEY, Macomb, Mississippi

THREE years as supervisor of mouth hygiene in the schools of a city having a population of 15,000 has taught me that successful mouth hygiene campaign consists of a great deal more than the mere giving of prophylactic treatments and the corresponding examinations and check-ups.

The clinic work of the program occupies a somewhat peculiar position in that it is one of the most important features and yet plays the smallest part

in a successful conclusion. The follow-up work, the educational outline, the records and the personal contact each has an important position.

Every step that is made must be carefully followed up to ascertain whether the original intent has been carried out. For example, if an examination has been made and defects requiring correction are noted, a notice is sent the parent. The first thing to be checked up is: Has the notice reached the proper hands? This can be determined by means of a blank slip attached to the note and to be signed by the parent and returned. If a list of the notes sent is kept, a satisfactory check-up can be made, and it is a simple matter to tell whether or not the parents have received the information that was intended for them.

By a check-up on each individual's card, a glance will tell just how many notices have been sent the parents. By various types of check marks, indicating the different types of notices sent, one is able to tell just how explicit the notices have been, because, of course, the notices are at first simple, and as more are necessary, they become more urgent and explicit.

This is just one of the steps in follow-up work, but it is a fair sample of what must be done in every instance. Unless the various steps are carried through to a conclusion, they will be of little avail.

Because of its importance, the educational part of the program should be given much consideration. The facts concerning the care of the mouth which are to be taught the children must be carefully planned and presented in as systematic a way as geography and history, in order and sequence and not in a hit or miss fashion. Only when this systematic procedure is followed will the desired result be obtained.

The attitude of the teachers and the children deserves much consideration. At the outset, the children must be made to realize that the hygienist is there for business, to teach them something and not to tell stories and be an entertainer, but that she brings to them lessons to be learned and recited, that her instruction takes equal place with their regular lessons. It is not intended that her visits shall be merely a cold statement of facts: quite the opposite; but the boundary line between mere entertainment and interesting instruction must be observed.

Unless the teacher is at the beginning thoroughly convinced of the importance of mouth hygiene instruction, the work will be doubly hard for the hygienist. When she is unconvinced, the visit of the hygienist will be looked on as a time in which she may make reports, visit or finish a magazine story, and having occupied her time in this way, she will be unable to lend any assistance in between visits in the way of follow-up work, such as reminders, comments or points driven home. Hence, the necessity for thoroughly convincing the teacher of the importance of mouth hygiene.

The manner of presenting the facts to the children is to be carefully considered. As little deviation as possible from the regular plan of teaching must be observed. If at the beginning of her work in a school, the hygienist will take the time to go into the rooms in which she expects to work and will observe the teachers' methods she will have

a fairly good idea as to how she should teach her subject in those particular rooms. Drastic changes are hard for little folks to accustom themselves to and should be avoided. If the work is presented to them in the way in which their other subjects are presented, there will be less difficulty experienced in making the subject clear, and the desired result will be more easily attained.

One thing is certain; unless an extensive educational program is mapped out and followed to a conclusion, the work at the chair will not alone accomplish the desired results.

Statistics are, after all, the real test as to whether or not the work is getting anywhere; therefore, records must be carefully kept. At the beginning, a selection should be made of the items of sufficient importance to be kept on record, and then these should be kept track of daily. When this is done, the work of record keeping which plays such an important part, will take the least time, but will be accurate. Above all things, accuracy must be maintained, for these records are the true story of the success or failure of the program.

That without help one cannot accomplish the greatest good is a proven fact; therefore, the success of the work is dependent on the cooperation of the teachers in the school, the superintendent, the board—in fact, the entire school organization. The local dentists and the parents each have their part. For this reason, contact must be made tactfully and graciously, as they may make or mar the work.

In outlining the work for each class, due consideration must be given the fact that the teacher's work is run on schedule and should be interfered with as little as possible. Extra work should be avoided. If charts and other records are to be kept by the teacher, their construction should be simple. Teachers are busy people and are liable to resent extra work from special teachers. Once resentment enters a teacher's mind, cooperation becomes impossible. This is one of the reasons why the friendship of the teacher should be most carefully cultivated: her attitude toward the work counts for much.

Discretion must be exercised in dealing with the dentists. Of all things, even the appearance of partiality should be avoided. Nothing could be more detrimental to the success of the work than for one dentist to be apparently favored more than another. If the dentists in the community once get the idea that such is the case, they will lose interest in the work and little or no cooperation can be expected from them. As to the worth of the work of any one of the dentists, no matter what the hygienist thinks, her thoughts should be shared with no one.

Contacts with the parents are equally important and thus should be made as early as possible. The hygienist should learn to know the parents and to win their regard. If she is known and liked, her ideas will be valued and her advice heeded. The parent is one of the links in the chain between the hygienist and the dentist, and it is important that this link be a strong one. Its strength depends in a large measure on the tact of the hygienist.

There are, of course, many other things which go to build up a successful program, but as I look back over three years, these things that I have mentioned occur to me as the most important "Do's" and "Don'ts".

DENTAL HEALTH WEEK IN PORT HURON, MICHIGAN

One of the best organized and most successful pieces of dental health promotion which has come to our attention was staged in Port Huron this spring by the local dental society. A well-thought-out plan, careful attention to details and splendid cooperation made this excellent result possible.

Plenty of time in advance, the little play, "The Bad Baby Molar" and health songs found in "Stepping Stones to Happiness," published by the Department of Dental Health Education of the American Dental Association, were given to four schools, two parochial and two public, which agreed to work up a program with them at an appointed date. These schools were so distributed as to cover four different sections of the city. Arrangements were made with the director of mouth hygiene and preventive dentistry of the state department of health to be present and address luncheon clubs, examine school children and speak at the close of each performance by the children. When the week came, the newspapers gave needed publicity, churches made announcement of the program from their pulpits on Sunday morning and many stores provided suitable window displays.

The program started with an address Monday evening before the Exchange Club. The next morning, there was a meeting with the local committee, and at noon, a luncheon conference with the school dentist and nurses. In the afternoon, at 2:30 o'clock, one of the schools put on its program for the school children, and this was repeated in the evening for the adults.

The next morning, the state director examined, with mouth mirror and probe, the second grades in two different schools and had present some members of the school board, all the public health nurses, a newspaper reporter and several other people. This is a wonderful help, for it is a revelation to those who have not seen such an examination. It also enables one to point out the evil effects of infection and the supreme importance of early attention to incipient cavities and furnishes actual local figures. In one room, we found 72 per cent of pupils with actual mouth infection, and one little girl, from a home in which the father was sick with tuberculosis, had eight abscessed teeth.

At noon, there was an address to the Lyons Club, and in the afternoon and evening, the same program as was given the day before in another school. This continued until Friday evening, and at Friday noon, there was a luncheon of the local dentists with a discussion of children's dentistry.

Everything went along according to schedule. A different dentist has been appointed to look after each school. He saw that the scenery was moved, helped the teachers with any details necessary and introduced the speaker after the play.

Teachers and pupils entered into the plan with whole hearted interest and enthusiasm. A prize had been offered for the school having the largest number of adults at the evening meeting. The play and songs by the children, of course, helped mightily to interest the parents.

Between 5,000 and 6,000 people actually heard this message through the schools alone. Too much credit for the success of this venture cannot be given Dr. Burr Stevens, president of the dental society, who laid the plans and worked with untiring energy for their success. Dr. Stevens was ably assisted by his local committee and had most loyal cooperation from dentists, teachers and nurses.

We believe this a worthy example for other places, although each must work out details according to local conditions. In smaller places, a one-day program would suffice, but the idea of an appropriate play and songs to bring out the parents to hear a health address is an excellent one.

WILLIAM R. DAVIS, D.D.S.
Director of Mouth Hygiene and Preventive Dentistry, Michigan State Department of Health.

EXTENSION COURSE IN DENTAL HYGIENE, FORSYTH DENTAL INFIRMARY, BOSTON, MASS.

(THE MASSACHUSETTS DEPARTMENT OF EDUCATION COOPERATING)

For the second year, Forsyth Dental Infirmary is offering an extension course in dental hygiene for hygienists who are gradu-

ates from an accredited school in dental hygiene.

Beginning July 11, 1927, these courses will be given daily from 9:00 a. m. to 4:00 p. m., except Saturdays, continuing until July 23.

Through cooperation with the Massachusetts Department of Education, University Extension Division, it is possible to offer special additional courses as part of the Forsyth summer course.

Toothbrush drill of rural school children in Japan.

The course will consist of lectures, conferences and reviews relating to dental hygiene in some of its newer aspects, including teaching methods, public speaking, nutrition, dietetics, psychology, pediatrics and field problems in dental hygiene.

The enrollment fee will be $20.00. A certificate will be awarded by the department of education to qualified students completing the courses in public speaking, teaching methods, child psychology, dietetics, prenatal and preschool hygiene and methods in health education, in addition to the certificate of attendance issued by the Forsyth Dental Infirmary.

FIELD NOTES

Miss Dorothy Bryant, director of the Division of Dental Hygiene, Maine State Department of Health, Augusta, Maine, has written a series of letters to the following groups, hoping to stimulate interest and develop a plan for dental health examinations and follow-up: The superintendent of schools is asked to supply the state department of health with a list of the names of children who are in the entering class of next September. This list includes the parents' or guardian's name and address. The dentists are asked to cooperate with the state department of health by giving free dental examinations to the entering class. The state department of health plans to send a series of letters to the parents of children in the entering class at intervals of a month. These letters emphasize the need of dental attention. The first was sent the middle of June; the next is to be sent the middle of July, and the last the middle of August. Each letter calls to the attention of the parent the importance of having the child's teeth examined by a dentist. Following are copies of the letters:

Letter Number I

June 15, 1927.

MY DEAR PARENTS:

Your child is growing up quite fast, as you realize, and next September will go to school. Naturally, you would like to see him at the head of the class. This is not possible unless the child is in splendid physical condition.

It has been definitely proved by observation and experiment that children with decayed and defective teeth are greatly retarded in their school work. They can neither eat well, rest well, nor study well, if they are suffering pain or auto-intoxication (self poisoning) from diseased teeth.

The dentists in your community have offered to examine, free of charge, any child who is to enter school next fall.

Will you not take your child to your dentist for an examination and, if any dental repair is needed, have it done at once before school begins, so that your child will have every chance of leading his class.

One school superintendent says that bad teeth will retard a child two or more years, and statistics reveal that approximately seventy men, women and children die every hour in the United States from preventable diseases, many of which are directly traceable to bad teeth.

Sincerely yours,

DOROTHY BRYANT, *Director*,
Division of Dental Hygiene.

Letter Number II

July 15, 1927.

MY DEAR PARENTS:

We hope that you have taken your child to your dentist for examination and that you have attended to the needed dental repair.

After a child is five years old, it is time to watch for the eruption of the permanent teeth. Usually the first to erupt are the so-called "six year molars." These are large SECOND teeth which take their places just in back of all the first teeth. Investigation has shown that 90 per cent of these six year molars have commenced to decay within three months after eruption. Consequently, they must be carefully watched by the dentist and filled as soon as there is any evidence of decay, if they are to be preserved through life.

This susceptibility to decay is due to faulty diet which has caused the enamel (outside protective substance of tooth) to be very thin and defective. A child's food has an immense influence on the development and resistance of his teeth. Foods that are rich in mineral matter will produce strong teeth. Those foods are milk, fresh fruits, vegetables, particularly the leafy varieties, eggs, whole grain cereals and breads. These same foods also supply coarseness for the teeth to chew upon, thereby supplying the necessary exercise.

There is nothing that will so quickly decay teeth as refined sugar in any form. Candy is decidedly destructive to teeth—chocolate being worse than anything else.

If you have not had your child's teeth attended to, will you not make an effort to do so *at once*, so that when school commences, with all its new problems, your child will not be bothered by tooth troubles.

Sincerely yours,

DOROTHY BRYANT, *Director*,
Division of Dental Hygiene.

Letter Number III

August 15, 1927.

MY DEAR PARENTS:

It is only two or three weeks to the time when school opens and, of course, you wish *your child* to do his very best work in school.

Have you had his teeth examined and repaired? If you have not, will you not do it right away, so that he may go to school on the very first day with a smile which will shown a mouthful of nice white teeth, well cared for.

Good teeth and success in school or anywhere else go hand in hand and surely each child is entitled to every chance for success.

A visit to the dentist for needed repair work, at this time, and a strict adherence to the advice of the dentist will prevent days of wasted school time and countless absences for your child.

School commences almost at once and your child will do much better work from the very beginning, if his teeth are in splendid condition.

Sincerely yours,

DOROTHY BRYANT, *Director*,
Division of Dental Hygiene.

The Findlay, Ohio, Dental Clinic was recently brought to the attention of the citizens when the report of its supervisor, J. H. Boger, was published in one of the local papers. The steady growth of the clinical service is noticeable and the spirit of the local men most admirable. Apropos of this, an editorial on the dental clinic appeared in the same issue, part of which is as follows:

"This report should be perused by all citizens. It gives in detailed fashion the facts and figures regarding the clinic since its establishment. It is interesting as well as instructive. Its author is Dr. J. H. Boger, dental supervisor in the schools, who has done so much to make the clinic the big success that it is.

"Nothing in the school curriculum has paid bigger dividends than the dental clinic. Its results are distinctly tangible. They are to be seen in improved health conditions among pupils, making possible better scholastic work. No child can do good school work when handicapped by such things as defective teeth or uncleanly mouths.

"The board of education can make no mistake in extending the scope of the dental clinic. It has proven its worth, many times, and its extension would bring increased benefit. The time has arrived, we believe, when local dentists should not be expected to give their services free of charge for further work in connection with the dental clinic. They have been doing so for twelve years, willingly and gladly. It would seem that the public should now be ready to bear this just expense through regular tax channels, with the employment of a regular dental examiner in the schools."

Palama Settlement, a social welfare organization, doing work only in the City of Honolulu, employs six dentists. One devotes all of his time to indigent adults, while the others confine their work to the first four grades, with special emphasis on the filling of the first permanent molars. Emergency cases of all grades are given attention.

HOSPITALS HAVING DENTAL DEPARTMENTS

The American Medical Association reports that there are 695 hospitals in this country having dental departments. The names of the hospitals in your state, the address, the type of hospital, the number of dentists on staff and the name of the administrative officer in charge can be obtained by writing to the Department of Dental Health Education of the American Dental Association.

Medical and Dental News

Arkansas

State Society Elects Officers: At the annual meeting of the Arkansas State Dental Association, at Hot Springs, May 12, the following officers were elected for the coming year: president, James T. Peay, Little Rock; president-elect, Nolan Helstern, Springdale; vice-president, C. C. Howard, Jonesboro; secretary, H. J. Crume, El Dorado (re-elected).

Illinois

Dr. Handler Named Lieutenant: Philip E. Handler, Chicago, recently received a five-year commission (reappointment) as first lieutenant in the United States Army Reserve Corps. Dr. Handler is a World War veteran, having served in the dental corps during the entire period of the war.

Dr. Hanaford Honored: M. L. Hanaford, Rockford, who has been practicing dentistry for fifty years was honored at a luncheon, May 11, at which Judge Carpenter of Rockford, M. R. Harned, Rockford, F. B. Noyes and C. N. Johnson, Chicago, and William F. Whalen, Peoria, spoke. Dr. Hanaford became a member of the state society in 1878 and served as its president in 1902.

Dedication of Ward Memorial Building: The dedication of the Montgomery Ward Memorial Building of Northwestern University Dental School took place June 15-17, dedicatory ceremonies being held in the William Bebb Library and Museum and William H. Trueman Room, Edmund Noyes Hall and Gilmer Hall. The G. V. Black Memorial was also dedicated. Clinics were presented each day, and the exercises closed with a convocation at which former Governor Frank O. Lowden spoke.

Indiana

Dr. Gillis Dental Examiner: R. R. Gillis, of Hammond, has been elected to serve a two year term on the state board of dental examiners.

Iowa

Society Officers for Coming Year: At the annual meeting of the Iowa State Dental Association, the following were elected to serve as officers for the ensuing year; president, F. N. Ralston, Des Moines; president-elect, Earle S. Smith, Iowa City; vice president, C. E. Westwood, Sioux City; secretary, John Scholten, Cedar Rapids (re-elected); treasurer, Frank Fourt, Fairfield (reelected).

Kansas

Dr. Parkhurst on Dental Board: J. L. Parkhurst, of Humboldt, was recently appointed as a member of the Kansas State Board of Dental Examiners.

Louisiana

State Society Elects Officers: At the annual meeting of the Louisiana State Dental Society held in March, the following officers were elected: president, W. B. Corley, Alexandria; first vice-president, L. J. Schoeny, Donaldsonville; second vice-president, T. S. Bennett, Lake Charles; secretary, M. F. Jarrell, Alexandria; treasurer, O. J. Ory, Garyville.

Maryland

Annual Meeting of State Association: The forty-fourth annual meeting of the Maryland State Dental Association was held at the Belvedere Hotel, Baltimore, May 2-4. Lecture demonstrations were given by George Wood Clapp, New York; T. W. Maves, Cleveland; M. M. House, Kansas City, and W. E. Cummer, Toronto. Papers were read

by L. Pierce Anthony, Philadelphia, and T. O. Heatwole, Baltimore. On the evening of May 3, the association and the national alumni association of the Baltimore College of Dental Surgery, Dental School, University of Maryland, tendered a testimonial banquet to T. O. Heatwole, former dean of the school. Thomas S. Eader, of Frederick, succeeded to the presidency of the association; E. W. Swinehart, Baltimore, was elected president-elect; L. L. Watkins, Hagerstown, vice-president; Walter E. Green, Baltimore, treasurer (reelected) and Norval H. McDonald, secretary (reelected).

Michigan

State Association Elects Officers. At the annual meeting of the Michigan State Dental Association, April 23, in Grand Rapids, the following were elected to serve as officers for the coming year: president, W. E. Brown, Benton Harbor; president-elect, P. C. Lowery, Detroit; vice-president, P. J. O'Reilly, Detroit.

Minnesota

Dr. Owre Honored: Dr. Alfred Owre, for twenty-two years dean of the College of Dentistry of the University of Minnesota, and dean-elect of the College of Dentistry of Columbia University, was the guest of honor at a dinner given at the Radisson Hotel, Minneapolis, by members of the dental profession. Speakers of the evening included L. D. Coffman, president of the University of Minnesota, H. L. Banzhaf, Milwaukee, Wis., president of the American Dental Association, C. H. Mayo, of the Mayo Clinic, Rochester, Minn., and the Hon. Henrik Shipstead, D.D.S., U. S. Senator from Minnesota.

Nebraska

State Society Elects Officers: At the close of the four-day session of the Nebraska State Dental Society, the following officers were named for the coming year: president, Ross W. Wintersteen, Holdrege; vice-president, H. A. Nelson, Omaha; secretary, H. E. King, Omaha; treasurer, Guy L. Spencer, Lincoln.

North Dakota

Annual Meeting of State Society: The twenty-second annual convention of the North Dakota State Dental Association was held in Fargo, May 17-19. Minot was selected as the meeting place for the 1928 session, and the following were elected officers for the ensuing year: president, F. J. Hartl, Minot; vice-president, R. W. Pote, Fargo; secretary, H. H. Ewy, Fargo; treasurer, R. S. Towne, Bismarck.

Oklahoma

New Officers of State Society: At the recent meeting of the Oklahoma State Dental Society, the following officers were elected for the ensuing year: president, Charles A. Furrow, Tulsa; president-elect, W. J. Scruton, Oklahoma City; secretary, Roy H. Ellis, Okmulgee (reelected); treasurer, C. A. D. Beer, Enid.

Pennsylvania

Annual Election of Officers of State Society: The following officers were elected at the annual meeting of the Pennsylvania State Dental Society; president, J. C. Nugent, Altoona; first vice-president, W. H. Fordham, Scranton; second vice-president, Z. T. Jackaway, Philadelphia; secretary, C. W. Hagan, Swissvale; assistant secretary, George A. Coleman, Philadelphia; treasurer, W. L. Fickes, Pittsburgh.

Alumni Reunion: Graduates for the past fifty years of the Philadelphia Dental College and Garretson Hospital of Oral Surgery held a reunion recently in the present quarters of the college, the sixty-fourth annual assemblage. Members came from all parts of the United States and from a number of foreign countries. Clinics, class reunions and a banquet occupied the day.

Death of Dr. Dorr: Henry Isaiah Dorr, professor emeritus of anesthesia in the Temple University School of Dentistry, died April 24, at the age of 82. Dr. Dorr was at one time treasurer of the dental school. Several years ago, he retired, and he had been living on his suburban estate. He created the Dorr fund of $50,000, under which, on his death, the School of Dentistry receives the income from this sum for dental research. It will be used to establish and maintain a laboratory. Dr. Dorr recently contributed $5,000 and property worth $2,500 to the dental school.

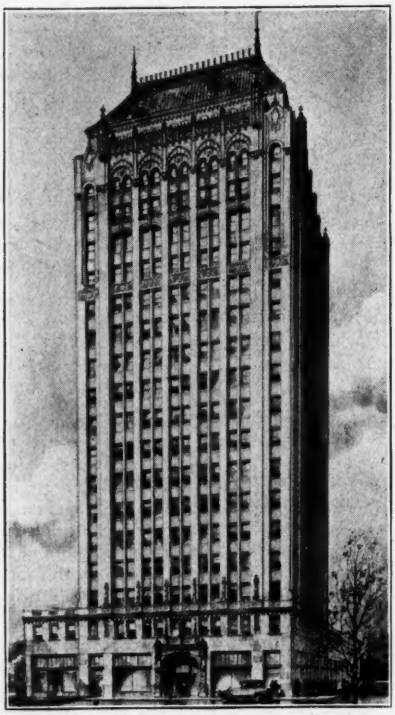
Texas

Annual Election of Officers: At the close of the annual meeting of the Texas State Dentists' Association, May 13, at Austin, the following officers were elected for the com-

ing year: president, T. F. Cox, Austin; vice-president, George H. Mengel, El Paso; secretary, C. C. Cruze, Tyler.

Utah

State Society Meets: The thirty-sixth annual meeting of the Utah State Dental Asso-



The Medical Arts Building, Forth Worth, Texas.

ciation was held at Ogden, June 8-10. Participating in the scientific program were F. F. Molt, Chicago, whose subject was radiography, local anesthesia and the preparation of the mouth for full dentures; Donald E. Smith, Los Angeles, who with three assistants gave clinics and lectures on fixed and removable crown and bridge work; Elmer W. Bunce, Las Vegas, Nev., whose subject was prosthetic dentistry; W. J. Charters, Des Moines, Iowa, presenting lectures and clinics on mouth hygiene and prophylaxis; W. S. Paine, Ogden, demonstrating the Winter technic for removal of impacted lower third molars; E. A. Hunt, Salt Lake City, whose subject was crown and bridge work, and W. H. Petty, Ogden, who spoke on mouth preparation for artificial dentures.

Virginia

State Association Elects Officers: At the annual three-day session of the Virginia State Dental Association, the following were elected officers for the ensuing year: president, W. G. Delp, Rural Retreat; president-elect, R. C. Walden, Richmond; secretary-treasurer, A. M. Walsh, Richmond (reelected). The next annual meeting will be held in Roanoke.

Wisconsin

Fox River Valley Society Meets: The annual meeting of the Fox River Valley Dental Society was held in Fond du Lac, May 17. Papers were read by J. P. Buckley, of Hollywood, Calif., on "Bone and Its Regeneration in Relation to the Pulpless Tooth and Its Treatment," and by W. H. G. Logan, Chicago, on "Cancer of the Mouth and Face as a Dental Problem." At the business session following the program, the following were elected officers for the ensuing year: president, T. J. Seiler, Neenah; secretary, J. A. Loomans, Waupun; treasurer, G. N. Ducklow, Neenah.

Wisconsin Academy of Dentists: The first annual banquet and meeting of the Wisconsin Academy of Dentists was held at the Hotel Pfister, Milwaukee, May 19. C. W. Hall, president of the new organization, outlined its objects, ideals and plans. Other speakers were H. L. Banzhaf, Milwaukee, Otto U. King, Chicago, Hart G. Goslee, Chicago, and U. G. Rickert, Ann Arbor, Mich., who spoke on "The Indications and Contraindications for the Preservation of the Pulpless Tooth."

General

Dr. Montgomery Transferred to Hawaii: Dr. L. C. Montgomery, an officer in the dental corps, after six years service in the naval hospitals at San Diego and San Pedro, Calif., has been ordered to Pear Harbor in the Hawaiian Islands, where he will be stationed for three years. Dr. Montgomery served for several years in the Philippine Islands.

Fraternity Banquets: Eta chapter of Delta Sigma Delta held their annual banquet at the Chicago Yacht Club, May 24. A. D. Black and Thomas L. Gilmer were the speakers of the evening.

DEATHS

Babcock, Warren, Syracuse, N. Y.; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, 1898; died, April 16.

Beetham, J. W., Fennimore Wis.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1892; died, April 15; aged 69.

Brown, Kenneth S., Philadelphia, Pa.; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania; was killed in an automobile accident, March 27; aged 37.

Bryan, J. W., Nashville, Tenn.; died, April 10, after a two years' illness; aged 69.

Burnham, F. D., Columbus, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati; died suddenly, April 9, of heart disease, following a severe attack of influenza.

Byrne, D. W., Brooklyn, N. Y.; New York College of Dentistry, 1891; died, April 7, after a five weeks' illness; aged 61.

Crim, Frank Baker, Washington, Ind.; died, April 2; aged 68.

DeLong, W. D., Reading, Pa.; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, 1894; died, March 28; aged 69.

Eisloeffel, Peter H., St. Louis, Mo.; Washington University School of Dentistry, 1890; died, a suicide, after a period of failing health; aged 61.

Flemister, W. A., Bardwell, Ky.; Vanderbilt University, School of Dentistry, 1882; died, April 9. Until 1916, Dr. Flemister practiced in Fordsville.

Fortier, Adelard, J., Pawtucket, R. I.; Baltimore College of Dental Surgery, 1894; died, April 14.

Fox, Horace E., Ironwood, Mich.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1889; died, March 31, of pneumonia; aged 67.

Hicks, E. M., Murfreesboro, Tenn.; died, March 22.

Hilbert, John Carl, Ladysmith, Wis.; Northwestern University Dental School, 1902; died, April 27.

Hines, L. B., Lodi, Calif.; College of Physicians and Surgeons of San Francisco, a School of Dentistry, 1902; died, March 28, after a several months' illness; aged 47.

Horner, Frank Cree, Wilkinsburg, Pa.; University of Pittsburgh, School of Dentistry, 1909; died, April 14; aged 38. Dr. Horner was a veteran of the World War.

House, F. C., Wilkes-Barre, Pa.; Baltimore College of Dental Surgery, 1902; died suddenly, February 18, of heart disease; aged 49. Dr. House was a veteran of the Spanish-American War.

Howd, J. B., Augusta, Ill.; Drake University College of Dentistry, 1909; died recently.

Husband, Ernest John, McPherson, Kan.; Temple University School of Dentistry; died, February 16; aged, 64. Dr. Husband had practiced in McPherson for thirty-nine years. He is survived by the widow and four children. Two sons, Ernest G. Husband, Hutchinson, and Myron W. Husband, Minneapolis, are dentists.

Israel, Harry W., Chicago, Ill.; died April 11.

Jacobi, J. G., St. Louis, Mo.; St. Louis University School of Dentistry, 1911; died from fracture of the skull sustained in a fall, February 3; aged 37. Dr. Jacobi formerly resided in Martinsburg.

Jacobs, Gordon, Carthage, Mo.; University of Buffalo, School of Dentistry, 1918; died, February 21.

Johnson, William F., Bango, Maine; died, February 22; aged 68.

Justice, Zoro K., Davidson, N. C.; died, February 13, from an accidental gunshot wound, while out hunting; aged 55.

Kamin, William A., Chicago, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1898; died, April 14; aged 58. Three of Dr. Kamin's sons, Julius C., Alfred D. and Emil Z., are dentists.

Kuns, Daniel J., Marseilles Ill.; Northwestern University Dental School, 1896; died, February 5, after an illness of several months; aged 73.

RESOLUTIONS ADOPTED BY THE AMERICAN SOCIETY OF ORTHODONTISTS

Chicago, May 4, 1927

THE American Society of Orthodontists subscribes to the following affirmation of items and principles relating to Dental Health.

WHEREAS: The correction of malocclusion is primarily a health measure: and

WHEREAS: The only solution of Dental Health, both locally and in relation to general health, lies in the prevention of oral disease: and

WHEREAS: Dental prevention is effective in inverse ratio to the age of the patient, Children's Dentistry is the logical field of preventive measures: and

WHEREAS: Orthodontists need the complete cooperation of the dentists to insure and maintain Dental Health before and during orthodontic procedure: and

WHEREAS: The principles of prevention, listed herewith, have been endorsed by fifteen State Dental conventions, three National Dental Associations and the Fédération Dentaire Internationale.

(a) Proper attention to initial defects.

(b) Particular care and attention to all pits, fissures and grooves before caries appears.

(c) No cavity is too small to fill.

(d) The deciduous teeth should have the same care and attention as the permanent ones, as their maintenance in health is essential to the proper development of adult occlusion: and

WHEREAS: Disregard of these principles and practices of accepted dental teachings constitutes a transgression of professional obligation to the patient, and a serious handicap to orthodontic procedure: Therefore be it

Resolved, That this declaration of policy is the unanimous expression of the belief of this organization, whose members are called upon to uphold it in all their relations with the Dental profession and the public: and be it further

Resolved, That copies of these resolutions should be displayed in each orthodontic office and sent to the dentist responsible for the care of the patient, immediately on the acceptance of a case: and be it further

Resolved, That this action be given publicity in professional journals and copies sent to the secretaries of various State, National and International Dental organizations and to Dental School associations.

FLORIDA'S FORWARD STEP IN DENTAL EDUCATION

By THOMAS P. HINMAN, D.D.S., Atlanta, Georgia

IT has remained for the Florida State Dental Society, one of the youngest active state societies in the Union, to point the way in advancing dental education to all members of the profession in the state.

It was my good fortune to be at the meeting of the society which was held at Daytona Beach, Oct. 28-30, 1926. at which time I was on the program twice. At my opening lecture, I found, much to my surprise, that one side of the room had been reserved for the colored dentists of the state. On inquiry, I learned that they had asked of the officers of the society the privilege of listening to the lectures and clinics, and, after consideration on the part of the officers, it was unanimously agreed to grant their request.

In doing this, I feel that the Florida State Dental Society should be both commended and congratulated; commended because of the spirit of brotherhood evidenced, and congratulated because, undoubtedly, the purpose of the society has been greatly enlarged by spreading its influence to their colored colleagues.

Certainly Florida is a pioneer in this movement. I have lectured in nearly every state in the Union but this is the first time that I have ever had an audience of both colored and white men. Naturally, I observed our colored brethren closely, and I was much pleased to note their respectful and attentive manner and also to see that they were assiduously taking notes on what was being said.

On Friday evening, October 29, at a banquest which was given to two of the oldest members of the society, the colored men were asked in to hear the speaking. At this time, one of them requested the privilege of expressing their appreciation of the services of the two honor guests to Florida. The request being granted, one of the men read a short article, which I think was a real classic. A notable expression in this speech was the likening of the two men who were being honored by the banquet to the Christ, when He said, "And I, if I be lifted up, will draw all men unto me."

At no time during the meeting did the much talked of question of "social equality" protrude itself. The men unquestionably seemed to have come with the one thought of getting needed help and knowledge from the meetings. They appeared promptly and quietly and, at the close of the meeting, they expressed to the proper officers of the society their gratitude for the privileges extended to them. Later, the society voted to accord these men the privilege to attend all its meetings.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Coincident Diphtheria and Vincent's Infection: A case in which diphtheria occurred coincidently with Vincent's infection is reported by R. S. Spray (*J.A.M.A.*, April 16, 1927). A young married woman presented obscure symptoms that led her to consult a physician. Five days later, a whitish, alubuminous membrane had appeared on the oral membranes. Four physicians, who examined the patient, were evenly divided as to whether the membrane was that of diphtheria or of Vincent's infection. Direct microscopic examination of a swab by the city laboratory revealed myriads of spirochetes and fusiform bacilli. The following day, cultures showed diphtheria bacilli. The author emphasizes the value of laboratory examinations and points out the fallacy of diagnosing a condition of the oral membranes from their visible character or by direct microscopic examination alone, with the comment that, while ordinarily a physical diagnosis of Vincent's infection, substantiated by a microscopic examination revealing the characteristic organisms, would be regarded as sufficient, in this case, without further investigation, the diphtheric infection would have been overlooked, and contact cases would have resulted.

Case of Actinomycosis: A case of actinomycosis is reported by Fulton Risdon (*Dominion Dent. J.*), in a man, aged 29. The patient was well developed and had no other untoward symptoms. Two weeks before examination (1917), he began to have pain, which was attended subsequently with swelling of the lower left jaw. Removal of a lower molar gave no relief, swelling and pain increasing. Repeated opening and drainage of the fluctuating point in the submaxillary region brought no relief. One month after admission, the evacuated pus showed sulphur granulas and the ray fungus. When seen in 1926, he had undergone incision and drainage twenty-seven times. He had many scars, areas of softening and induration, and marked trismus, being able to open the jaws about one-fourth of normal. A necrosis and zygoma, present at one time, had cleared up. The ray fungus was not found at this time. Treatment had consisted of potassium iodid therapy, with silver nitrate applied to the numerous sinuses, and roentgen ray exposures. At the time of writing, the patient was being treated with radium, from six to eight emanations a month, with practically no other therapy.

Use of Soap in Prophylaxis of Vincent's Infections: In a series of tests among the American forces in Coblenz, in which the effects of the use of various soap solutions were noted in cases of Vincent's infection, tonsillar in type, with gingival involvement in 40 per cent of cases, and on the basis of previous experimentation, Reasoner and Gill (*J.A.M.A.*) reach the following conclusions: 1. Vincent's spirochete is an important factor in the production of the pathologic lesions of Vincent's infections. 2. Determination of the spirochete by means of dark field examination affords a rapid and accurate method of diagnosis when checked against the clinical picture. 3. Vincent's spirochete may be an inhabitant of the apparently normal buccal cavity. Its presence under these conditions is a potential source of danger to the person harboring it and to others closely associated with the carrier. Solutions of ordinary toilet soaps, as well as pure soaps prepared in the laboratory, have a selective action on this class of organisms and a definite spirocheticidal effect, and their use in dentifrices assists in keeping the oral cavity free from mouth spirochetes, thereby affording a measure of protection against tissue infection. 5. The laurates, palmites, myristates and oleates are all efficient for this purpose, probably in the order mentioned. 6. The presence of the organisms of this

disease and of the disease itself vary inversely with the care given to personal hygiene and the regular use of soap by the persons concerned. 7. Any measures that retard or prevent chronic irritations of the mouth will doubtless have some effect in lowering the incidence of cancer of the mouth. 8. The proper use of soap and soap compounds is rather that of a prophylactic than a method of cure, and their use for the latter purpose is not recommended.

Specific Treatment of Noma: A case of gangrenous stomatitis in an infant, aged 16 months, did not follow any other illness. The gangrenous area was extensive involving more than one-half of the right cheek and the angle of the mouth. There was sloughing of the gums, and spirochetes and fusiform bacilli were found in smears from the lesions. Three intravenous doses of neoarsphenamine, of 0.2, 0.3 and 0.15 gm., respectively, were given over a period of ten days. Potassium chlorate was given by mouth in a dosage of 5 grains (0.32 gm.) five times a day. The mouth was cleaned with hydrogen peroxide followed by tincture of myrrh. Ten per cent silver nitrate was applied twice. A definite line of demarcation ultimately formed, and the gangrenous area was removed by cautery. The patient made an uneventful recovery and is at present in good condition, although there is a small amount of fibrous contracture about the angle of the mouth.—H. L. Berger, in *Am. J. Dis. Child.*

Surgical Treatment of Epithelioma of the Lip: Following a report on 187 cases of cancer of the lip, in patients admitted over a period of ten years, presented in 1922, William M. Shedden (*Boston M. & S. J.*) reports a second series from the Massachusetts General Hospital and the Cancer Commission of Harvard University, including 107 cases occurring through the four year period from Jan. 1, 1919, to Jan. 1, 1923. Ninety-four cases were primary and thirteen recurrent. There was a gain of six in the average number of primary cases admitted in this later period. All cases were included in which an attempt was made at a surgical cure, and a pathologic examination was invariably required. Correlating the two reports the results are as follows: radical operations, 201, palliative, 56, no operation, 9; operative mortality, radical operations, 3, palliative, 1; inconclusive cases: no pathologic report, 7, died without recurrence, in less than three years, 11; untraced, 41; cases available for end-result data, 200 (43 simple, 157 radical operations); number of three year cures, 143; patients alive and well, 127, died without recurrence, after three years, 16; radical operations, 118, simple, 25. The author concludes: 1. The "radical" neck dissection as described will give 3-year cures in 76 per cent of the cases. 2. This "radical" dissection will give 42 per cent of cures even when cancer is present in the glands. 3. Metastatic cervical gland cancer can exist in the absence of palpable glands. Palpable glands do not necessarily mean cancer. 4. It is most necessary to excise chronic ulcers and tumors of the lip, if there is a possibility of cancer, and to have a microscopic examination of the tissue excised. 5. Separation of the tumors into pathologic groups depending on relative malignancy is apparently of distinct value as regards prognosis and choice of operation. 6. The delay between onset and admission to the hospital, and that between the visit to the doctor and admission to the hospital is too long. 7. The position of the growth on the lip should determine whether the neck dissection is to be bilateral or unilateral. 8. More neck dissections could be done on the otherwise inoperable cases if sufficient narcosis and local anesthesia were employed. 9. Syphilis is not commonly seen with cancer of the lip and its presence should not delay adequate operative procedures. 10. Heredity plays a minor part in this disease.

Some Chronic Enlargements of the Jaws: Two cases of osteomyelitis of the mandible in children are reported by E. C. Hughes (*Brit. Dent. J.*, Feb. 1, 1927). In the first case, that of a girl, aged 5, there was a history of swelling of the right side of the jaw and face, two months earlier, with some pain. Poultices did not reduce the swelling. That the point of the chin was deviated by the swelling was shown by failure of occlusion of the incisors. In the sulcus outside the temporary molars was a sinus from which granulation tissue protruded and along which a probe could be passed to impinge upon the bare bone. The possible diagnosis of sarcoma was strongly considered. Exploration showed it to be a widespread necrosis of the angle and ascending ramus, with two large

sequestrums which were removed through the sinus in the mouth. A splint was made to prevent further deviation of the mandible to the side of the swelling. Five months after the onset of the disease, there was still swelling, a sinus was still present, and the child continued to wear a splint. The second case was that of a boy, aged 9, whose condition was very similar to that of the patient in the first case. Sequestrums were removed from time to time, and, after four years, there is deviation of the jaw and swelling, in spite of resection of the condylar process, coronoid processes and a portion of the ascending ramus. The author warns against the temptation to curet in these conditions, as living cancellous bone may be interfered with and infection may be spread to the unaffected bone. Radiograms are of great assistance in determining the position, number, size and shape of the sequestrums. The two cases cited show "how serious a neglected osteomyelitis of the jaw may be, the prolonged invalidism, the many operations for removal of sequestrums, the liability to spontaneous fracture and some permanent disfigurement and disability." Adequate treatment, the author adds, at the onset of the infection, i. e., early extraction to provide an exit for the inflammatory products, will prevent the spread of inflammation into the interior of the bone.

The Care of the Patient: In all your patients whose symptoms are of functional origin, the whole problem of diagnosis and treatment depends on your insight into the patient's character and personal life, and in every case of organic disease there are complex interactions between the pathologic processes and the intellectual processes which you must appreciate and consider if you would be a wise clinician. There are moments, of course, in cases of serious illness when you will think solely of the disease and its treatment; but when the corner is turned and the immediate crisis is passed, you must give your attention to the patient. Disease in man is never exactly the same as disease in an experimental animal, for in man the disease at once affects and is affected by what we call the emotional life. Thus, the physician who attempts to take care of a patient while he neglects this factor is as unscientific as the investigator who neglects to control all the conditions that may affect his experiment. The good physician knows his patients through and through, and his knowledge is bought dearly. Time, sympathy and understanding must be lavishly dispensed, but the reward is to be found in that personal bond which forms the greatest satisfaction of the practice of medicine. One of the essential qualities of the clinician is interest in humanity, for the secret of the care of the patient is in caring for the patient.—Francis W. Peabody, in *J.A.M.A.*

Opium-Smoking as an Anesthetic: The Dental Surgeon quotes from the *British Medical Journal* a case in which the smoking of opium was the means of anesthetizing an injured Siamese laborer when the medical officer, G. L. Deshmulsh, of the ship on which the accident occurred, had no one to aid him by administering chloroform. The report reads: "After a few whiffs, he permitted me to wash the part and replace the structures; a few more puffs and I was able to suture the rent. He was by this time fast asleep, and we removed him to hospital on board the vessel. On awakening, he began to feel the part and inquired what had happened. We remained in the neighborhood for seven days, and then sent the patient to a hospital at some distance. The report received from the hospital stated that there was no sepsis and that he was improving. I leave it to the medical world and to scientists to decide whether opium smoke is to take a place in the field of anesthetics." *The Dental Surgeon* comments: "In the days before anesthetics as we employ the term, were introduced, opium was occasionally used to diminish insensibility to pain in operations and in recent years its use has been reintroduced as an adjuvant to anesthetics. There is, so far as we know, no reason why the administration of opium by smoking should not have a sphere of usefulness in cases where the usual anesthetics are contraindicated; but there would be, of course, the objection that it might easily lead to addiction."

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Academy of Periodontology, October 20-22, 1927, Detroit, Michigan.

American Dental Assistants Association, October 24, 1927, Detroit, Michigan.

American Dental Hygienists Association, October 24-28, 1927, Detroit, Michigan.

American Dental Association, October 24-28, 1927, Detroit, Michigan.

American Society of Oral Surgeons and Exodontists, October 21-22, 1927, Detroit, Michigan.

American Dental Society of Europe, August 1-3, 1927, Paris.

European Orthodontological Society, July 21-22, 1927, London, England.

International Dental Federation, August 6-9, 1927, Copenhagen.

Sixth Australian Dental Congress, August 22-27, 1927, Melbourne, Australia.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

July (1927)

Porto Rico, at San Juan.
Wisconsin, at Milwaukee (12-14).
Washington, at Seattle (18-20).

September (1927)

Maryland, at Hagerstown (12).

October (1927)

Florida, at St. Petersburg.

December (1927)

Ohio, at Cleveland (2-4).

February (1928)

Minnesota, at Minneapolis (Feb. 29-March 2).

March (1928)

Louisiana, at Shreveport.
Montana, at Missoula (29-31).

April (1928)

California, at Stockton (9-12).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Montana, at Helena, July 11, 1927. Secretary, Marshall E. Gates, Helena, Montana.

Utah, July 11, 1927. Secretary, S. S. Burnham, 801 Ezra Thompson Building, Salt Lake City, Utah.

National Association of Dental Examiners, at Detroit, Michigan, October 22, 1927. Secretary-Treasurer, George L. Powers, Memphis, Tennessee.

LOUISIANA STATE DENTAL SOCIETY

The next meeting of the Louisiana State Dental Society will be held in Shreveport, in March, 1928.

M. F. JARREL, *Secretary*,
Commercial Bank Bldg.,
Alexandria, La.

MARYLAND STATE DENTAL ASSOCIATION

The semiannual meeting of the Maryland State Dental Association will be held, September 12, at Hagerstown.

NORVAL H. MCDONALD, *Secretary*,
304 Morris Bldg.,
Baltimore, Md.

EL PASO COUNTY DENTAL SOCIETY

Members of the American Dental Association who are passing through El Paso are urged to bring their papers and clinical material with them and use their stop-over privileges for a stay in El Paso in the interest of and to contribute to the El Paso County Dental Society whatever is new and of interest in dentistry. The committee promises golf, an unequaled climate, beautiful scenery, excellent hotel facilities and an opportunity to see old Mexico.

L. A. NEIL, *Chairman*,
Program Committee,
El Paso County Dental Society,
El Paso, Texas.

WASHINGTON STATE DENTAL ASSOCIATION

The annual meeting of the Washington State Dental Association will be held in Seattle, July 18-20. T. B. Hartzell of Minneapolis, Minn., and G. M. Hollenbeck, Los Angeles, will be among the clinicians.

WILL G. CROSBY, *Sec'y-Treas.*,
Medical and Dental Bldg.,
Seattle, Wash.

WYOMING STATE DENTAL ASSOCIATION

The Wyoming State Board of Dental Examiners will meet in Cheyenne, June 28-30. Address communications to

I. P. HAYES, *Sec'y-Treas.*,
Sheridan, Wyo.

MONTANA STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the Montana State Board of Dental Examiners will take place, July 11, at Helena. Applicants wishing to take examination, address

MARSHALL E. GATES, *Secretary*,
Helena, Mont.

SOUTH CAROLINA BOARD OF DENTAL EXAMINERS

The next regular meeting of the South Carolina State Board of Dental Examiners will be held at the Imperial Hotel, Greenville, June 20, beginning promptly at 9 o'clock. For application blanks and further information, address

W. B. SIMMONS, *Sec'y-Treas.*,
107 E. North St.,
Greenville, S. C.

UTAH STATE BOARD OF DENTAL EXAMINERS

The next examination of the Utah State Dental Association will be held commencing July 11.

S. S. BURNHAM, *Secretary*,
801 Ezra Thompson Bldg.,
Salt Lake City, Utah.

DEWEY SCHOOL OF ORTHODONTIA, ALUMNI SOCIETY

The Alumni Society of the Dewey School of Orthodontia will hold a scientific meeting at the Vanderbilt Hotel, New York City, the week beginning August 29. August 29-31 will be devoted to the consideration of scientific papers. The remaining portion of the week will be taken up with clinics and practical demonstrations. All members of the dental profession who are interested in orthodontia are invited to be present. A more detailed program will be given later.

P. G. SPENCER, *President*,
Amicable Bldg.,
Waco, Texas.

HARRY A. HOLDER, *Sec'y*,
Bennie-Dillon Bldg.,
Nashville, Tenn.

CONCERNING PEDODONTISTS

If you are limiting your practice to the care of children or if you know of any dentist in your community engaged in this specialty, will you kindly forward this information to the Detroit Pedodontic Society.

S. D. HARRIS, *Secretary*,
412 Kresge Bldg.,
Detroit, Mich.

BALTIMORE COLLEGE OF DENTAL SURGERY, DENTAL SCHOOL, UNIVERSITY OF MARYLAND NATIONAL ALUMNI ASSOCIATION

The National Alumni Association of the Baltimore College of Dental Surgery, Dental School, University of Maryland, will maintain headquarters at the Book-Cadillac Hotel during the meeting of the American Dental Association, October 24-28. All graduates of the Baltimore College of Dental Surgery, Baltimore Medical College, Dental Department, and Dental Department of the University of Maryland are requested to visit the rooms during the meeting and register.

F. P. DUFFY, *President*,
G. E. HARDY, *Chairman*,
Executive Committee.

TRANSPORTATION TO THE ANNUAL SESSION OF THE A. D. A., DETROIT

An Identification Certificate will be sent to each member of the American Dental Association, approximately one month in advance of the meeting. When properly filled out and presented to the local railway agent, it will authorize him to sell a round trip ticket to the member for himself and dependent members of his family, at one and one-half fares. Selling dates for these tickets will be October 15-17-18-19-22-24 and 25, with return limit, November 3.

D. C. BACON, *Chairman*,
Transportation Committee.

XI PSI PHI FRATERNITY, SUPREME CHAPTER

The Supreme Chapter, Xi Psi Phi, will hold its biennial meeting, October 21-22, at the Hotel Tuller, Detroit, Mich. A banquet will be held, Monday, October 24. All members of the fraternity are welcome.

H. B. PINNEY, *Sec'y-Treas.*,
108 N. State St.,
Chicago, Ill.

XI PSI PHI FRATERNITY, NATIONAL ALUMNI CHAPTER

The National Alumni Chapter, Xi Psi Phi, will hold its annual meeting, October 24, at the Hotel Tuller, Detroit, Mich.

J. H. BILLINGS, *President*,
G. W. HILLIAS, *Secy-Treas.*,
Bryant Bldg.,
Kansas City, Mo.

WARNING
IMPORTANT NOTICE

One thousand (1,000) checks on the Treasurer of the United States, numbered from 2001 to 3000 inclusive, were recently stolen from the Philadelphia Navy Yard, bearing symbol number 18,161 in the lower right hand corner below the signature of the issuing officer.

These checks are now being passed among dentists and the method of procedure is as follows: The passer, who has very defective teeth will call on a dentist, and arrange to have some work done. He will volunteer to make an immediate payment and will use one of these checks for a greater amount than the payment and receive the difference from the dentist.

This man is using the name of E. T. Carson, and checks are purported to be signed by J. B. Kennedy. The original symbol number is crossed out with a typewriter and a substituted typewritten symbol number is used. Checks passed bear number 18,158.

He is described as 40 years of age; 5 feet, 8 inches tall; weighing 135 pounds; blue eyes; brown hair; sallow sickly complexion. He wears a fedora hat and mouse colored or brown suit. He furnishes for identification an application for leave of absence and a reply on the bottom addressed to E. T. Carson.

He may use other names and symbol numbers, also letters of identification, and if symbol numbers and any change in them is watched for, may be readily detected.

In case any one answering the foregoing description tenders the above-described checks, call police and notify the nearest U. S. Secret Service. If possible, hold the passer.

He also uses the name E. T. Lawson as payee and uses the original symbol number 18,161.

SOME RECENT BOOKS

Available for Circulation from

THE DEPARTMENT OF LITERARY RESEARCH
AMERICAN DENTAL ASSOCIATION

Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
Bulleid, Arthur	Text-book of bacteriology for dental students. St. Louis, Mosby, 1927.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners, based upon the original; rewritten by Otto E. Inglis. Philadelphia, Lea & Febiger, 1926.
Federspiel, M. N.	Harelip and cleft palate. St. Louis, Mosby, 1927.
Feldman, M. H.	Manual of exodontia. Philadelphia, Lea & Febiger, 1926.
Fones, A. C.	Mouth hygiene; a textbook for dental hygienists. Philadelphia, Lea & Febiger, 1927.
Gwinn, C. D.	Text-book of exodontia. Philadelphia, Lea & Febiger, 1927.
Kells, C. E.	Dentist's own book, including a complete bookkeeping and recording system and a description of the management of a dental practice. St. Louis, Mosby, 1925.
McCoy, J. D.	Applied orthodontia: an introductory text for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1927.
McGaw, Emma J.	Dental assistant. St. Louis, Mosby, 1926.
Marshall, J. A.	Diseases of the teeth; their diagnosis and treatment. Philadelphia, Lea & Febiger, 1926. Outlines of dental science. New York, Wood, 1926. Vol. I. Dental anesthesia by G. F. R. Smith. Vol. II. Dental bacteriology by R. A. Broderick. Vol. III. Dental materia medica by P. H. Marsden. Vol. IV. Dental prosthetics by J. D. Logan. Vol. V. Dental radiography by C. A. Clark.
Owre, Alfred	Prunes or pancakes. Minneapolis, University Minnesota Press 1926.
Prinz, Hermann	Dental materia medica and therapeutics. St. Louis, Mosby, 1926.
Raper, H. R.	Clinical preventive dentistry. Rochester, N. Y., Ritter Dental Mfg. Co., 1926.
Simon, P. W.	Fundamental principles of a systematic diagnosis of dental anomalies. Boston, Stratford, 1926.
Simpson, C. O.	Technic of oral radiography. St. Louis, Mosby, 1926.

Wallace, J. S.	Teeth and health. London, Faber & Gwyer, 1926.
Wallace, J. S.	Variations in the form of the jaws, with special reference to their etiology and their relation to the occlusion of the dental arches. New York, Wood, 1926.
Ward, L., Ed.	American text-book of operative dentistry. Philadelphia, Lea & Febiger, 1926.
Weinberger, B. W.	Orthodontics: an historical review of its origin and evolution, including an extensive bibliography of orthodontic literature up to the time of its specialization. 2 vols. St. Louis, Mosby, 1926.
Wells, F. M.	Sound teeth in a sound body. Montreal, The Author, 1926.
Winter, G. B.	Principles of exodontia, as applied to the impacted mandibular third molar. St. Louis, American Medical Book Co., 1926.
Winter, Leo	Textbook of exodontia. St. Louis, Mosby, 1927.

Books may be borrowed for a period of one week after date of receipt. A deposit of $2.00 for each volume asked for should accompany all requests for books. This will be refunded on return of books.

BOOK REVIEWS

Applied Orthodontia, an Introductory Text for Students and Practitioners of Dentistry. By James David McCoy, M.S., D.D.S., F.A.C.D. Professor of Orthodontia in the College of Dentistry, University of Southern California, Los Angeles, Calif. Ed. 2, thoroughly revised. Illustrated with 228 engravings. 322 pages. Price $4.00. Published by Lea & Febiger, Philadelphia, 1927.

This book does not pretend to be so comprehensive as some of the works on orthodontia, nor does it need to be when its function is considered. The author says in his preface: "In the preparation of this text the needs of the undergraduate have been made the paramount consideration. With this end in mind an effort has been made to lay down elemental principles." And yet there is no question that the practitioner of orthodontia will glean much of real value in its pages.

One of the most interesting chapters is that on "Hereditary and Congenital Factors in Malocclusion." The author discusses, in some detail, the influence of heredity, and this is always a fascinating subject. In short, Dr. McCoy stresses the factors which determine irregularity of the teeth, and tries to point out the fact that the chief thing to consider is not the manipulation of mechanical appliances, but the biologic fundamentals involved. That this is the proper approach to the consideration of any subject, there can be no question, and in this respect the present volume is most satisfactory.

The mechanical make-up of the book is excellent, as is usual with this well-known publishing house.

A Textbook of Dental Pathology and Therapeutics, For Students and Practitioners, Based upon the Original of Henry H. Burchard, M.D., D.D.S., Formerly Special Lecturer on Dental Pathology and Therapeutics in the Philadelphia Dental College. Rewritten by Otto E. Inglis, D.D.S., Professor Emeritus of Dental Pathology and Therapeutics in the Dental School of Temple University (Philadelphia Dental College). Seventh Edition, thoroughly revised. Illustrated with 770 engravings and a colored plate. 879 pages. Price, $7.50. Published by Lea & Febiger, Philadelphia, 1926.

The fact that this work runs into seven editions is *prima facie* evidence that there must be merit in it. This standard old work, the basis of which was laid so well by the late Dr. Burchard, has been reviewed so often that a detailed consideration seems unnecessary. In the present edition, an effort has been made by Dr. Inglis to bring it to date, and there is a commendable tendency in treating on subjects uppermost in the minds of the profession at this time to adhere to conservative statements rather than to follow the prevalent bent of too much radicalism. It is sometimes difficult for the average author to keep his feet on the ground in the face of a wind-swept sensationalism, but in the long run this is the safer course, and we congratulate Dr. Inglis on his balance in this particular.

A Textbook of Bacteriology for Dental Students. By Arthur Bulleid, L.R.C.P., (Lond.) M.R.C.S., L.D.S., (Eng.), Assistant Dental Surgeon and Assistant Bacteriologist to Guy's Hospital. With 24 plates (one colored) and 36 illustrations in the text. 219 pages. Price, $4.50. Published by The C. V. Mosby Company, St. Louis, Mo., 1927.

The aim of this book is to condense the information on bacteriology, and bring it within the needs of the student. It becomes confusing to the average student to attempt to grasp the essential points in the bacteriology of the mouth by wading through the larger books dealing with the entire subject of bacteriology as it relates to the whole body. This book, therefore, will make an especial appeal to dental students who have not time to go fully into detailed bacteriology in all its branches.

An interesting presentation is the one on "Recent Bacteriology of Caries," in which it is claimed that the micro-organisms engaged in the initial decalcifying process are *B. acidophilus-odontolyticus*, Types I and II. These micro-organisms are described in some detail. More and more the profession is concerned in the factors which bring about decay of the teeth, and anything which throws light on the subject should be welcomed and carefully noted. We are in full accord with the effort to condense the information necessary for dental students on this subject, because we have a conviction that today our students are burdened with too much irrelevant material in many of the branches of study.

Mouth Hygiene, A Textbook for Dental Hygienists. Compiled and edited by Alfred C. Fones, D.D.S., Bridgeport, Connecticut. Third Edition, thoroughly revised. With 219 illustrations and 9 plates. 348 pages. Price $5.00. Published by Lea & Febiger, Philadelphia, 1927.

The development of the dental hygienist movement is one of the outstanding things in modern dentistry. From a modest beginning about fifteen years ago, it has grown, till today, there are twenty-six states which officially recognize the dental hygienist, and there are more than 2,000 dental hygienists registered in these states. As Dr. Fones says in his preface: "Such remarkable growth can only be attributed to the intrinsic value of the work of these women." This, of course, is perfectly true, but in justice to Dr. Fones it should always be remembered that to him goes the credit for starting this movement and giving it the initial impetus. It was his vision which grasped the possibilities of the dental hygienist, and the credit is due him for writing the first textbook on mouth hygiene for the hygienist. The present volume is the third edition, and the fact that any work runs into three editions on a special subject such as this is evidence not only of the interest in the subject itself, but also of the fact that the book measures up to the needs of the situation.

Dr. Fones, in addition to his own contribution has called to his aid some of the leading men in the profession as contributors, and the result is a work of intrinsic merit which should be in the hands not only of the dental hygienist herself but of the professional man as well.